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ADDITIONS TO THE APHID FAUNA OF FORMOSA (HEMIPTERA), IV [1]

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THREE TEXT FIGURES

LACHNUS TATAKÆNSIS sp. nov.

Wingless viviparous female.—Brownish black, not darker around the bases of dorsal setæ, with many rather large black circular spots in transverse rows on the dorsum of abdomen (about six spots in a row on each segment). Antennæ black, paler on the basal part of third segment. Cornicles, cauda, and dorsal setæ black. Femora reddish brown except on the distal black part; tibiæ black, with a reddish brown part near the base. In specimens treated with caustic potash, head, thorax, and median area of basal abdominal segment dark brown on the dorsum, many small irregular brown patches present near the hind end.

Body wide, convex, covered with numerous simple setæ, which are a little or not curved and much shorter than the second antennal segment. Head divided, with many curved setæ on the front, which is nearly straight. Eyes with distinct ocular tubercles. Antennæ not imbricated, with many simple setæ, which are stiff or a little curved, pointed, and as long as, or shorter than, the diameter of the third segment; the third segment constricted at the base, as long as the distal three

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segments taken together, with none to eight small circular sensoria in a row or scattered on the distal part; the fourth with five to eight similar sensoria not in a single row; the fifth with none to four similar sensoria besides a large circular primary one; distal part of the sixth about twice as long as wide; the relative lengths of segments about as follows: III—66, IV—22, V—23, VI—13+7. Rostrum reaching a little beyond the hind coxæ, pointed. Dorsum faintly reticulate, lacking tubercles, with numerous very small granules in rows on the black parts. Cornicles large, on hairy cones; the cones black in specimens treated with caustic potash, with very small granules in transverse rows; hairs on cones slightly longer than those on the abdomen. Cauda short, very broadly rounded. Legs with many simple long setæ, which are stiff or slightly curved; tibiæ much stouter than the third antennal segment, with setæ which are much shorter than the diameter of tibiæ. Body, about 5.5–5.7 millimeters; antenna, 2.2; width of third antennal segment at middle, 0.74–0.78; seta on antenna, 0.07; diameter of apex of cornicle, 0.16–0.18, at base of cone, 0.55–0.59; length of hind tibia, 4.5; width, 0.125; length of hind tarsus, 0.47; dorsal seta on abdomen, 0.09; diameter of larger dorsal spot on abdomen, 0.23–0.27; width of cauda, 0.46.

Host.—*Salix* sp., attacking the stem and branch.

Habitat.—Tataka (altitude 9,000 feet) near Mount Niitaka, (Mount Morrison).

Many specimens were collected by me July 25, 1936. Allied to *Lachnus saligna* Gmelin, from which it differs in the absence of dorsal tubercles, in the larger body with larger dorsal spots, and in other characters.

In Formosa *Lachnus saligna* Gmelin is found in the lowlands and the lower mountainous regions (below 3,500 feet); it does not occur at very high altitudes.

CINARA JUNIPERI De Geer.

Panimerus juniperi THEOBALD, Plant Lice Gr. Britain 3 (1929) 149.

Wingless viviparous female.—Brown, darker on the head and pronotum, with a pair of large dark spots on the meso- and metanotum and also on the basal abdominal segment; and a few small dark spots on the abdomen, especially on the posterior part, most of them at the bases of setæ. Antennæ pale, dark at the apices of the third and fourth segments and on the distal halves of the fifth and sixth. Legs paler at the bases of femora, brown or yellowish brown in specimens treated with caustic potash.

Body with many very long setæ, which are curved and nearly as long as the basal two antennal segments taken together. Head divided. Ocular tubercles very short. Antennæ not imbricated, with many setæ as long as those on the body; the third segment a little constricted basally, without sensoria; the fourth with one or two circular sensoria on the distal part; the fifth with a similar sensorium near a large primary one; the sixth with about six small sensoria in a loose group below a primary sensorium, the distal part slender, about thrice as long as wide, a little tapering, with some short stiff setæ; the relative lengths of segments about as follows: III—80, IV—40, V—48, VI—41+14. Rostrum acutely pointed apically, reaching beyond the hind coxæ, the penultimate segment widest. Cones of the cornicles with many fine setæ and much fewer, but much longer and stouter, setæ mixed; the longer setæ a little smaller than those on the body. Cauda with six very long bristles and some much smaller bristles. Legs covered with many setæ, which are as long as those on the body; tibiæ much stouter than the third antennal segment; tarsi not striate, hind tarsi slightly shorter than the third antennal segment, the distal segment about 3.8 times as long as the basal. Length of body, 2.9 millimeters; antenna, 1.2; width of third antennal segment at middle, 0.046; diameter of cornicle at apex, 0.1; at base of cone 0.3–0.4; width of cauda, 0.277; length of hind tibia, 1.7; width at middle 0.08; length of hind tarsus, 0.34; dorsal seta, 0.185.

Host—Juniperus squamata Lambert.

Habitat.—Kanko (altitude 8,300 feet) near Mount Niitaka (Mount Morrison).

Some specimens were taken by me August 23, 1936. New to the fauna of Formosa. The specimens are identical with the European and American specimens sent to me by Dr. D. Hille Ris Lambers and Prof. E. O. Essig.

GREENIDEA NIGRA Maki var. KANZANENSIS var. nov.

Wingless viviparous female.—Blackish brown, cornicles blackish. Body sclerotized, with numerous long fine setæ, which are a little curved, not branched apically, and as long as, or a little shorter than, the basal two antennal segments taken together. Head fused with the pronotum, with about thirty-two dorsal setæ. Antennæ with many long fine setæ, which are as long as the basal two antennal segments taken together; the third segment not curved, striate on the distal half, lacking sensoria; the relative lengths of segments about as follows: III—44, IV—15, V—15, VI—11 + 24. Cornicles reticulate near the base, slightly

constricted at the base, broadest about the middle, longer than the third antennal segment, with many minute spinules in transverse rows on the distal part, and many long simple setæ. Caudal segment with a very small process. Trochanters defined from the femora; tibiæ not striate, with three or four slender spines at the tip. Length of body, 3.0 millimeters; width across abdomen, 1.9; width of head across eyes, 0.623; antenna, 1.85; width of third antennal segment at middle, 0.046; longest seta on third antennal segment, 0.185; length of cornicle, 0.97; width at base, 0.11; width at middle, 0.17; width at apex excluding flange, 0.083; seta on cornicle, 0.21; hind tibia, length, 0.12; width at middle, 0.051; longest seta on hind tibia, 0.162; hind tarsus, 0.175; dorsal seta, 0.14–0.18.

Winged viviparous female.—In specimens treated with caustic potash, abdomen pale brownish over the dorsum. Cornicles black. Head with about thirty-two dorsal setæ. Third antennal segment slightly striate on the distal part, with twenty-five to twenty-seven transversely narrowed or oval sensoria nearly in a row along the whole length except on the basal and distal small parts; fourth without sensoria; relative lengths of segments about as follows: III—48, IV—16, V—16, VI—12 + 26. Wing veins and stigma normal. Cornicles very long, cylindrical, very slightly narrowed and curved at the apical part, somewhat shorter than the antenna, with pale transverse striæ except at the base and on the distal part, many minute spinules in rows on the distal part, and many very long simple setæ. Caudal segment with a small, but distinct, process. Length of body, 2.7 millimeters; length of head, 0.26; width of head, 0.6; seta on head, 0.15; antenna, 2.1; width of third antennal segment at middle, 0.051; longest seta on antenna, 0.018; length of cornicle, 1.85; width of cornicle at middle, 0.12; width of cornicle at apex, 0.074; seta on cornicle, 0.25–0.32; length of hind tibia, 1.38; width of hind tibia at middle, 0.046; hind tarsus, 0.162; seta on abdomen, 0.046–0.069.

Host.—A species of Fagaceæ?

Habitat.—Reikwan (altitude 6,220 feet), Kizan-gun, Takao Prefecture.

Some specimens were taken by me in July, 1936. *Greenidea nigra* var. *kanzanensis* differs from the typical form of *Greenidea nigra* Maki in the fine setæ on the body, antennæ, legs, and cornicles of the wingless form, and on the head and antennæ of the winged form.

PARATRICHOSIPHUM NIITAKAENSE sp. nov.

Wingless viviparous female.—Yellow, without dark markings. Antennæ pale, darker on the distal part. Cornicles and legs pale yellow. Body elongate, rounded on the side of abdomen, with many very long fine setæ, which are not branched at the tip. Head shallowly and widely convex on the front, fused with the pronotum, with about twelve or thirteen long dorsal setæ, which are a little longer than the basal two antennal segments taken together, and with a pair of similar setæ on the frontal convex part. Eyes with prominent ocular tubercles. Frontal tubercles very short, indistinct. Antennæ imbricated, with long simple setæ; the first segment concave at the middle of lateral side; the third lacking sensoria, with about twenty to twenty-five setæ, the longer ones of which are as long as those on the dorsum of head; the fourth with four setæ; relative lengths of segments about as follows: III—39, IV—12, V—15, VI—11 + 17. Rostrum slender, pointed, reaching a little beyond the hind coxæ. Abdomen a little corrugated on the dorsum. Cornicles long, slightly curved, narrowed on the basal and distal parts, stouter than the femora, a little longer than the third, fourth, and fifth antennal segments taken together, not striate, not reticulate, with many long simple setæ, numerous spinules in rows on the distal part, and spinules scattered on the remaining part. Caudal segment rounded, with about ten long setæ, with no process. Legs slender; trochanters defined from the femora; femora imbricated; hind tibiæ somewhat curved, striate, with four slender spines at the end, and a few simple fine setæ, which are nearly as long as, or shorter than, the width of tibiæ; tarsi striate, with some long simple setæ on the basal segment. Venter with numerous granules on the thorax and over the whole surface of abdomen, granules pointed apically. Length of body, 2.2–2.5 millimeters; width of body, about 1.0; width of head across eyes, 0.44; length of antenna, 1.4; width of third antennal segment at middle, 0.032; length of cornicle, 0.95; width of cornicle at base, 0.069; width of cornicle at middle, 0.129; width of cornicle at apex excluding flange, 0.05; length of hind tibia, 0.8; width of hind tibia at middle, 0.037; length of hind tarsus, 0.12; dorsal seta on head and abdomen, 0.16; longest seta on cornicle, 0.18 to 0.21.

Winged viviparous female.—In a specimen treated with caustic potash, head, thorax, legs, antennæ, and cornicles dark brown, abdomen brownish. Head with about twelve long fine setæ on

the dorsum, setæ curved and as long as, or shorter than, the basal two antennal segments taken together; front with a pair of small rounded protuberances and some long setæ at the middle. The third antennal segment with many transversely narrowed sensoria in a row, and setæ which are as long as the dorsal setæ of head. Cornicles very long, cylindrical, a little narrowed on the apical part, a little longer than the hind tibia, not striate, not reticulate, with many spinules in rows on the distal part, and very long simple fine setæ. Caudal segment with no process. Wing veins and stigma normal. Legs slender, with many long fine setæ; middle and hind femora a little imbricated; hind tibiæ striate, the setæ much longer than the width of tibiæ. Length of body, 2.25 millimeters; length of head, 0.2; width of head across eyes, 0.41; width of third antennal segment, 0.037; longest seta on third antennal segment, 0.16; length of cornicle, 1.25; width of cornicle at base, 0.07; width of cornicle at apex excluding flange, 0.046; longest seta on cornicle, 0.23; distance between cornicles, 0.41; length of hind tibia, 1.1; width of hind tibia at middle, 0.032; hind tarsus, 0.125; longer seta on tibia, 0.115; forewing, about 2.8.

Host.—A species of Fagaceæ.

Habitat.—Taikan (altitude about 6,500 feet), near Mount Niitaka (Mount Morrison).

A winged and some wingless forms were collected by me August 23, 1936. This species is closely related to *Paratrichosiphum montanum* van der Goot (syn. *Trichosiphum montanum* van der Goot) briefly described from Darjiling, India, and may be identical with it. I here designate it as new, since comparison cannot be made in detail.

AMPHOROPHORA LESPEDEZÆ Essig and Kuwana.

Rhopalosiphium lespedezæ ESSIG and KUWANA, Proc. Calif. Acad. Sci. IV 3 (1918) 57.

Host.—*Lespedeza* sp.

Habitat.—Musha (altitude 3,790 feet).

Many specimens, both alate and apterous, were taken by me July 11, 1936. Previously recorded from Japan, Korea, and China.

MACROSIPHUM SMILACETI Takahashi.

Macrosiphum smilaceti TAKAHASHI, Aphididae of Formosa III, Dept. Agr., Govt. Res. Inst. Formosa Rept. 10 (1924) 101.

Wingless viviparous female.—Red, black on the dorsum, shining; cornicles black; cauda pale. Dorsum sclerotized; basal

seven abdominal segments fused together. Head somewhat convex at the middle of front, with four pairs of dorsal simple setæ, which are rather long, but much shorter than the second antennal segment. The third antennal segment not imbricated, with one to three small sensoria on the basal part. Cornicles very stout, imbricated, not distinctly reticulate, longer than the width of head including the eyes, as long as the fourth antennal segment. Cauda large, stout, with a median and six or eight lateral bristles. Femora long.

Host.—*Smilax* sp.

Habitat.—Hinokidani (altitude 8,000 feet), Kizan-gun, Takao Prefecture.

Four apterous forms were taken by me in July, 1936. Previously known from Japan and Korea.

MACROSIPHUM EURYÆ sp. nov.

Wingless viviparous female.—Yellow; head and pro- and mesonotum black; abdomen with a large black patch on the median area of dorsum, and a broad black band behind the cornicles; the black patch reaching the base of abdomen and confluent with the band. Cornicles black; cauda yellow. Legs pale. Antennæ pale, blackish on the basal segment, somewhat dusky on the apices of the fourth, fifth, and sixth segments and on the distal area of basal part of the sixth. Body oval. Head transversely corrugated on the posterior part of dorsum, lacking granules and spinules, with four pairs of dorsal stiff setæ, which are rather long, as long as the second antennal segment, and each arising from a small tubercle; a pair of these setæ nearly on the front; front prominently protruding and rounded at the middle. Venter of head with two pairs of setæ between the eyes. Frontal tubercles developed, diverging, the mesal side convex, with some striæ and two setæ; space between the frontal tubercles much wider than the tubercles. Antennæ slender, imbricated, with a few small stiff setæ; the basal segment nearly as long as wide; the second somewhat longer than wide, much smaller than the basal; the third lacking sensoria, with about nine setæ, which are much shorter than the diameter of the segment; the relative lengths of segments about as follows: III—48, IV—38, V—38, VI—28 + 70. Rostrum reaching the middle coxæ, the distal segment longer than the penultimate, nearly twice as long as wide, blunt apically; the penultimate as long as wide. Thorax corrugated on the dorsum, with some dorsal setæ, which are similar to those on the head; abdomen less corrugated on the dorsum, with transverse rows of spinules on

the last two segments and behind the cornicles. Cornicles stout, broadened towards the base, a little or much curved, directed posteriorly, roughly imbricated, not reticulate, much longer than the third antennal segment, nearly as long as the width of head, stouter than, and about 2.5 times as long as, the cauda, stouter than the femora, with an apical flange. Cauda a little tapering, not much narrowed distally, long, rounded at the apex, with a median and four lateral curved setæ. Anal plate normal. Legs slender, with some short stiff setæ; middle and hind femora slightly imbricated on the apical part; tibiæ stouter than the third antennal segment, slightly imbricated on the apical part, a little widened on the distal part; tarsi striate, shorter than the basal part of the sixth antennal segment, with three short setæ on the basal segment, of which the median one is stout. Length of body, 1.25 millimeters; length of head, 0.162; width of head including eyes, 0.35; antenna, 1.29; width of third antennal segment at middle, 0.019; length of cornicle, 0.35; width of cornicle at base, about 0.092; width of cornicle at apex excluding flange, 0.042; length of cauda, 0.148; width of cauda at base, 0.07; length of hind tibia, 0.69; width of hind tibia at middle, 0.028; hind tarsus, 0.088; dorsal seta, 0.046.

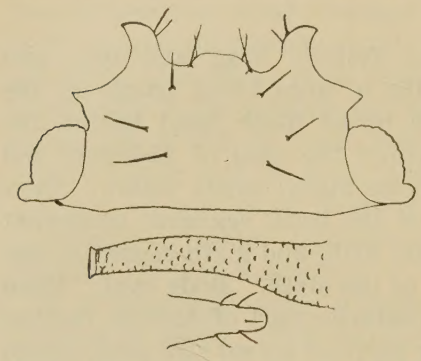

FIG. 1. *Macrosiphum euryæ* sp. nov., wingless viviparous female; head, cornicle, and cauda.

Host.—*Eurya* sp.

Habitat.—Hinokidani (altitude 8,000 feet), Kizan-gun, Takao Prefecture.

Some apterous forms were taken by me in July, 1936. This species is not a typical form of the genus, and resembles *Macrosiphum holsti* Takahashi in lacking sensoria on the third antennal segment and in the dorsum not being smooth; it differs from the latter in the color, the structure of the cornicles, and in other characters.

ACYRTHOSIPHON RHODODENDRI sp. nov.

Wingless viviparous female.—Green. Antennæ and legs pale; cornicles pale, darker on the distal part; cauda black. In specimens treated with caustic potash, pro- and mesonotum pale brown, the eighth abdominal tergite with a small pale brown

band. Head smooth except on the mesal sides of frontal tubercles, with four very small blunt dorsal setæ in a row between the eyes, and two pairs of longer similar setæ between the frontal tubercles, the anterior pair of which is longer, but much shorter than the second antennal segment; front with two pairs of similar setæ. Frontal tubercles developed, diverging, moderately convex and with two short setæ and numerous granules on the mesal side; space between the frontal tubercles nearly as wide as the tubercles. Antennæ long, slender, with some very small blunt setæ; the third segment not imbricated, expanded at the apex, with one or two (usually one) small circular sensoria near the base and about twenty setæ; the fourth expanded at the apex, without sensoria; relative lengths of segments about as follows: III—30, IV—23, V—24, VI—10 + 34. Rostrum reaching a little beyond the hind coxæ, the distal segment somewhat longer than the penultimate, somewhat tapering. Thorax and abdomen with a few minute blunt dorsal setæ; pronotum corrugated; meso- and metanotum and dorsum of abdomen reticulate; posterior abdominal segments and mesosternum with spinules in rows. Cornicles cylindrical, stout, widened towards the base, not curved, directed posteriorly, smooth, lacking reticulations and imbrications, nearly as long as the cauda, shorter than the width of head across the eyes, slightly shorter than the fourth antennal segment, with one or two striæ at the apex, and a distinct apical flange. Cauda narrow, tapering, blunt apically, with three pairs of lateral setæ and a median seta. Anal plate normal, with three pairs of setæ on the hind margin. Legs long, slender; coxæ with spinules in rows; femora slightly imbricated apically; tibiæ as stout as the middle part of the third antennal segment, a little imbricated at the apical part, with many short setæ, which are shorter than the diameter of tibiæ; tarsi striate, shorter than the basal part of the last antennal segment, with three short stiff setæ on the

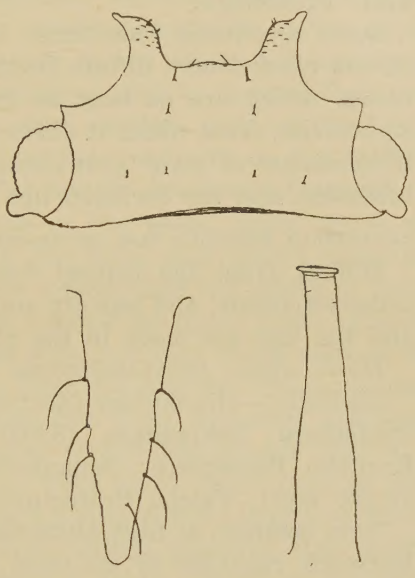

FIG. 2. *Acyrthosiphon rhododendri* sp. nov., wingless viviparous female; head, cauda, and cornicle.

basal segment, the median seta stout. Length of body, 1.4 millimeters; length of head, 0.16; width of head across eyes, 0.42; antenna, 2.0; width of third antennal segment at middle, 0.028; length of cornicle, 0.32; width of cornicle at base, 0.069; width of cornicle at apex excluding flange, 0.037; length of cauda, 0.277; width of cauda at base, 0.095; length of hind femur, 0.55; width of hind femur about middle, 0.065; length of hind tibia, 1.0; width of hind tibia at middle, 0.028; length of hind tarsus, 0.11.

Host.—*Rhododendron oldhami* Maxim.

Habitats.—Hariposon (altitude 6,699 feet), Koyo (8,349 feet), Taito Prefecture.

Some specimens were taken by me June 30, 1936. *Acyrthosiphon rhododendri* differs from other species in the short cornicles, which are as long as the cauda. It resembles *Macrosiphoniella,* from which it differs in the convex frontal tubercles, the presence of many granules on the mesal sides of the frontal tubercles, and the cornicles not being reticulate.

CAVARIELLA JAPONICA Essig and Kuwana var. NIGRA var. nov.

Differs from the typical form in that the body, antennæ, cornicles, cauda, and legs are entirely black in the apterous form, and the legs are black in the alate form.

Host.—*Salix fulvo-pubescens* Hayata.

Habitats.—Hinokidani (altitude 8,000 feet), Kizan-gun, Takao Prefecture; Sekigahara (8,600 feet), Gokwan (9,600 feet), Karenko Prefecture; Sankakuho (7,000 feet), Sakuragamine (9,100 feet), Taichu Prefecture.

Very common at high altitudes, but not found in the lowlands. Formerly recorded by me from Formosa as *Cavariella japonica* Essig and Kuwana. Many specimens were collected by me in July and August, 1936. In the wingless viviparous female, dorsum sclerotized except on the anterior part of mesothorax, with a few small irregular pale areas arranged in a longitudinal line on the thorax and basal part of abdomen; metathorax and basal seven abdominal segments fused together.

CAVARIELLA CAPREÆ Fabricius.

Cavariella capreæ THEOBALD, Plant Lice Gr. Britain 2 (1927) 5.

Wingless viviparous female.—Pale yellowish white. Antennæ pale, dusky on the distal two segments. Legs pale, dusky on the tarsi. Cornicles, cauda, and dorsal horn concolorous with the body. Body normal in shape, prominently reticulate on the dorsum. Head convex and with a pair of short stiff blunt se-

tæ on the front; a similar, but shorter, seta on the mesal side of each frontal tubercle. Eyes rather small, protruding. Antennæ slender, short, reaching posterior part of mesothorax, 6-segmented, with a few small setæ; the third segment slightly imbricated, without sensoria; the fifth narrowed towards the base; relative lengths of segments about as follows; III—44, IV—20, V—15, VI—15+20. Rostrum reaching the middle coxæ, the distal segment slightly longer than the penultimate. Pro- and mesonotum equal in length, slightly shorter than the head; metathorax and basal seven abdominal segments fused together; dorsal horn on the eighth abdominal segment about 2.5 times as long as wide, very slightly tapering, rounded at the apex, not constricted, corrugated, as long as the cauda, but narrower than the cauda and cornicles, reaching slightly beyond the apex of cauda, with a pair of short stout capitate setæ on the apex. Cornicles long, prominently expanded gradually on the middle part, broadest beyond the middle; faintly imbricated throughout, sometimes with about two striæ at the apex, about thrice as long as the cauda, longer than the third and fourth antennal segments taken together, slightly longer than the width of head across the eyes, reaching a little beyond the tip of horn. Cauda stout, about 1.5 times as long as wide, rounded at the apex, with five setæ. Trochanters defined from the femora; tibiæ widened on the distal part, stouter than the third antennal segment, not striate, with some stiff setæ, which are shorter than the diameter of tibiæ; tarsi striate, with three short setæ on the basal segment. Length of body, 1.5 millimeters; length of head, 0.185; width of head across eyes, 0.365; antenna, 0.6; width of third antennal segment at middle, 0.019; length of cornicle, 0.38; width of cornicle at base, 0.046; width of cornicle at widest part, 0.064; width of cornicle at apex excluding flange, 0.029; length of cauda, 0.125; width of cauda at base, 0.083; length of horn, about 0.127; width of horn at middle, 0.037; length of hind tibia, 0.6; width of hind tibia about middle, 0.03.

Host.—Salix fulvo-pubescens Hayata.

Habitats.—Gokwan (altitude 9,600 feet), Karenko Prefecture; Tataka (9,000 feet) near Mount Niitaka (Mount Morrison).

A few specimens were taken by me in August, 1936. New to the fauna of Formosa. Differs from *Cavariella neocapreæ* Takahashi, which is found on *Salix* in the lowlands of Formosa, in the cornicles distinctly expanded beyond the middle and in

the shorter dorsal horn. According to D. Hille Ris Lambers [2] *Cavariella capreæ* Fabricius is a synonym of *C. pastinacæ* Linné.

APHIS ARUNDINARIÆ sp. nov.

Wingless viviparous female.—Purplish brown. In specimens treated with caustic potash, antennæ pale, colorless on the third segment, pale brownish on the apical part of the penultimate segment and on the last; fore and middle femora pale brownish except on the distal part; tibiæ brownish on the apex; tarsi brownish or dusky; cornicles and cauda also brownish or dusky; abdomen with five small brownish patches on the side and many small pale brown spots at the bases of setæ. Body like *Aphis bambusæ* Fullaway in shape, with many very long rather fine simple setæ. Head smooth, shallowly and widely convex on the middle of front, with about four pairs of dorsal setæ, which are longer than the basal two antennal segments taken together; a pair of similar setæ present on the front, and about four pairs also on the venter of head. Frontal tubercles very short, not convex, with a long seta on the mesal side. Eyes normal. Antennæ short, 5-segmented, with many long fine setæ, setæ a little shorter than those on the head and longer than the basal part of the last antennal segment, each arising from a small tubercle; the first segment wider than long, with three setæ; the second with four setæ; the third not imbricated, lacking sensoria, with about fifteen setæ; the fourth not striate, with nine setæ, the primary sensorium small, apart from the tip of the segment; the fifth imbricated, a little narrowed basally, the distal part long, slender, longer than the third; relative lengths of segments about as follows: III—44, IV—26, V—16+60. Rostrum very short, reaching a little beyond the front coxæ. Thorax and abdomen not reticulate, some of the dorsal setæ a little longer than those on head; abdomen with a small lateral tubercle on the basal and

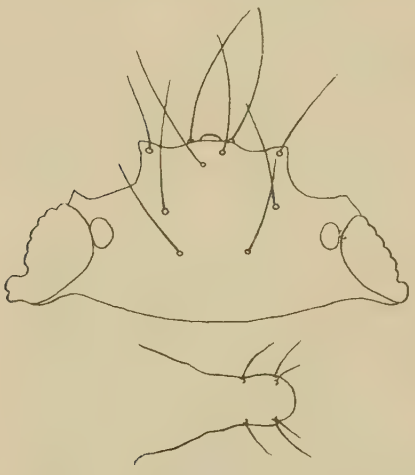

FIG. 3. *Aphis arundinariae* sp. nov., winged viviparous female; head and cauda.

[2] Stylops 3 (1934) 25.

seventh segments, tubercle distinctly longer than wide; dorsal setæ of abdomen mostly in an irregular row on each segment. Cornicles short, twice as long as wide, a little widened toward the base, as long as the cauda, somewhat faintly imbricated, shorter than the dorsal setæ of abdomen, as stout as the basal part of tibia, a little shorter than the penultimate antennal segment, with a distinct apical flange. Cauda normal, rounded apically, moderately constricted about the middle, with two pairs of lateral curved setæ and a median seta. Legs with many long fine setæ; femora with a small circular sensorium near the base; tibiæ stouter than the third antennal segment, hind tibiæ slightly narrowed towards the apex, not striate, stiff setæ lacking; tarsi striate, shorter than the penultimate antennal segment, with three short setæ on the basal segment in the fore and middle pairs, but only two setæ in the hind pair. Length of body, 1.2 millimeters; length of head, 0.162; width of head across eyes, 0.354; antenna, 0.83; width of third antennal segment, 0.028; longest seta on antenna, 0.115; length of cornicle, 0.101; width of cornicle at apex excluding flange, 0.037; hind femur, 0.37; length of hind tibia, 0.623; width of hind tibia at middle, 0.037; hind tarsus, 0.083; longest seta on abdomen, 0.15.

Winged viviparous female.—In specimens treated with caustic potash, head and thorax brownish; antennæ dusky; femora pale brownish; abdomen with some large pale brown lateral patches, median pale brown bands, and some small spots between the lateral patches and dorsal bands; wings hyaline, with pale veins and stigma; other parts like the wingless form in color. Head shallowly and widely convex on the front, with three pairs of long fine simple setæ on the dorsum, and a pair of similar setæ on the front; these setæ slightly shorter than the basal two antennal segments taken together; venter of head with five pairs of similar setæ. Frontal tubercles as in the wingless form. Antennæ 6-segmented; the third segment somewhat striate, with eleven to eighteen protruding sensoria scattered over the whole length, and about fourteen long fine setæ, setæ longer than the diameter of the segment and nearly as long as the basal antennal segment; the fourth with two to six sensoria and about thirteen similar setæ; the fifth with two to five sensoria and about ten setæ; relative lengths of segments about as follows: III—47, IV—30, V—34, VI—19+55. Front ocellus visible from above. Cornicles nearly as long as the longer setæ of abdomen, stouter than the tibiæ, shorter than the penultimate antennal segment. Cauda somewhat constricted about middle, with three pairs of setæ.

Wing veins normal, hind wings with parallel oblique veins, hooklets 2. Other characters like the wingless form. Length of body, 1.18 millimeters; length of head, about 0.13; width of head across eyes, 0.33; antenna, 0.9; length of cornicle, 0.092; width of cornicle at base, 0.05; width of cornicle at apex excluding flange, 0.032; hind femur, 0.37; length of hind tibia, 0.69; width of tibia at middle, about 0.027; hind tarsus, 0.092; longest seta on tibia, 0.095; longest seta on abdomen, 0.095.

Host.—*Arundinaria niitakayamensis* Hayata.

Habitat.—Arisan (altitude 7,500 feet).

A few specimens were collected by me August 25, 1936. Closely allied to *Aphis bambusæ* Fullaway, but differing in possessing many long fine setæ on the body, antennæ, and legs, in the frontal tubercles not protruding mesad, in having more sensoria on the antennæ of the winged form, in the wings not being clouded along the veins, and in other characters.

APHIS STRANVÆSIÆ sp. nov.

Wingless viviparous female.—Green. Antennæ, cornicles, and cauda black. Legs almost entirely black. Head about twice as wide as long (including the eyes), somewhat convex on the front, with four fine dorsal setæ in a row between the eyes and a pair of similar setæ between the antennæ, which are somewhat shorter than the second antennal segment; two pairs of curved setæ on front. Antennæ imbricated, with a few fine simple setæ, setæ nearly as long as the diameter of the third segment; the third segment narrower than the tibiæ, shorter than the width of head across the eyes, usually without sensoria, but sometimes with two to four small circular sensoria in a row mostly on the distal half, with about ten setæ; relative lengths of segments about as follows: III—20, IV—15, V—12, VI—8+14. Rostrum reaching beyond the middle coxæ, widest on the penultimate segment; distal segment nearly as long as the penultimate, a little longer than twice the width at base. Dorsum reticulate on thorax and abdomen, with a few short fine setæ. Prothorax, and the first, second, fourth, and seventh abdominal segments each with a lateral tubercle, the tubercle on the prothorax prominent, conical or slender, about twice as long as, or a little longer than, wide, larger than those on the abdomen; those on the first and seventh abdominal segments larger than those on the second and fourth. Cornicles cylindrical, a little broadened towards the base, sometimes very slightly constricted near the apical part, 1.5 times as long as the cauda, shorter than width of head, nearly as long as third antennal segment,

imbricated, the distal part as stout as the tibiæ. Cauda stout, rounded at the tip, constricted about the middle, about 1.5 times as long as the basal part of the last antennal segment, slightly longer than the head, with about ten to fifteen setæ. Legs long, with many curved fine setæ; tibiæ stout, hind tibiæ slightly curved, with many setæ, which are as long as, or somewhat longer than, the diameter of tibiæ; tarsi imbricated, with three short stiff setæ on the basal segment. Length of body, 2.0 millimeters; length of antenna, 1.1; width of third antennal segment, 0.028; length of prothoracic tubercle, 0.04; length of cornicle, 0.3; width of cornicle at base, 0.07; width of cornicle at apex, 0.046; length of cauda, 0.21; width of cauda on distal half, 0.069; length of hind tibia, 0.9; width of hind tibia at middle, 0.046; hind tarsus, 0.12; dorsal seta on head, 0.041.

Winged viviparous female.—Head, antennæ, thorax, cornicles, and cauda black. Legs nearly black. Abdomen with four large black patches on the side, a large black patch behind each cornicle, and three black bands on the posterior part of dorsum. Third antennal segment with seven to nine circular sensoria in a row; fourth with none to two sensoria; relative lengths of segments about as follows: III—19, IV—14, V—14, VI—9+20. Wings normal, second branch of media rather short. Length of body, 1.75 millimeters; antenna, 1.25; length of third antennal segment, 0.31; width of third antennal segment, 0.032; length of cornicle, 0.25; width of cornicle at apex excluding flange, 0.045; length of cauda, 0.17; width of cauda on distal part, 0.055; length of hind tibia, 1.0; width of hind tibia at middle, 0.037; hind tarsus, 0.125.

Host.—Stranvæsia niitakayamensis Hayata.

Habitats.—Sakuragamine (altitude 9,300 feet), Gokwanzan (about 9,800 feet), Taichu Prefecture.

Numerous specimens were collected by me August 12 and 13, 1936. Many species of *Aphis* have been very incompletely described from Japan and other countries, and they cannot be compared with the present species in detail. *Aphis stranvæsiæ* differs from Theobald's description of *Aphis plantaginis* Schrank in the black legs, the cornicles about 1.5 times as long as the cauda, and the more constricted cauda. The present new species is similar to *Aphis odinæ* van der Goot in the shape of the cauda, but the cauda is less hairy in the former.

THORACAPHIS TAROKOENSIS sp. nov.

Wingless viviparous female.—Black, strongly sclerotized, with much white wax at center of dorsum, and slight white wax on

margin. Legs, cauda, and antennæ black. Body wide, broadest at the middle, prominently indented at the middle of front, about 1.3 times as long as wide, with no evident setæ. Dorsum reticulate except on a large longitudinal median area, area paler, somewhat corrugated, and reaching hind end of cephalothorax. Head and thorax fused, occupying most of body; thoracic segments faintly discernible. Abdomen much reduced, broadly rounded on basal margin, separated from thorax, a little protruding posteriorly; basal seven abdominal segments fused, eighth defined, much wider than long, nearly triangular, bluntly pointed posteriorly, not distinctly reticulate, much shorter than remaining part of abdomen. Eyes of three facets, submarginal, dorsal. Antennæ very short, longer than wide, not segmented, rounded apically, separated from body margin, on mesal part of ventral marginal area of body. Apices of hind femora, and hind tibiæ and tarsi exposed, other legs concealed under body; hind tibiæ a little longer than femora, slightly narrowed toward apex, without setæ, reaching hind end of body; hind tarsi not segmented, short, a little longer than wide, without claws, but with two long fine apical setæ, setæ as long as tarsi. Cornicles wanting. Cauda and anal plate concealed under body. Venter of body with the marginal part well separated from the median area. Length of body, 0.9–0.946 millimeters; width of body, 0.72; length of basal seven abdominal segments together, 0.129; length of hind tibia, about 0.111; width of hind tibia, 0.035; hind tarsus, 0.023.

Host.—*Quercus spinosa* David., attacking lower side of leaf.

Habitat.—Seraoka (altitude 4,420 feet), Taroko, Karenko Prefecture.

Some specimens were taken by me August 14, 1936. Related to *Thoracaphis quercicola* Takahashi and *T. distyllifoliæ* Takahashi, but differing from the former in the median area of dorsum being paler and wanting reticulations, and in the presence of wax on the body; and from the latter in the larger body, the front prominently indented at the middle, and the dorsum reticulate except on the median area.

TETRANEURA RADICICOLA Strand.

Tetraneura sp., TAKAHASHI, Aphididae of Formosa IV, Dept. Agr., Govt. Res. Inst. Formosa Rept. 16 (1925) 54; ibid. V, Rept. 22 (1927) 14.

Tetraneura radicicola STRAND, Acta Univ. Latv. 20 (1929) 22; TAKAHASHI, Aphididae of Formosa VI, Dept. Agr., Govt. Res. Inst. Formosa Rept. 53 (1931) 101.

Winged viviparous female.—Head with some long, rather fine, simple setæ on dorsum and front, setæ a little curved and much longer than basal antennal segment. Antennæ with some long setæ, setæ much longer than diameter of third segment; third segment constricted basally, with thirteen sensoria in a row, sensoria very narrow, a little wavy and occupying half the circumference of segment or less; fourth narrowed on the basal part, about twice as long as wide, with four sensoria and about seven long setæ; fifth narrowed basally, with twelve sensoria, about eighteen long setæ, and many microtrichiæ in rows on the distal part, the primary sensorium small, at the apex of the segment, surrounded with setæ; sixth about twice as long as wide, wanting secondary sensoria, with two long bristles and many rows of microtrichiæ; relative lengths of segments about as follows: III—16, IV—6, V—16, VI—5. Rostrum nearly reaching middle coxæ, with long bristles. Abdomen with many fine long bristles, bristles approximately as long as, or shorter than, those on head, bristles on the posterior segments much larger. Cornicles surrounded with seven long setæ; dorsum somewhat sclerotized around the bases of cornicles. Cauda wider than cornicles. Legs with many long setæ; trochanters defined from femora; tibiæ stout, a little stouter than the third antennal segment, with many microtrichiæ in rows on distal part; tibial setæ a little curved, as long as, or a little longer than, diameter of tibiæ; tarsi with numerous microtrichiæ in rows, fore tarsi with two long setæ and a much shorter stiff median seta on basal segment, but middle and hind tarsi with only two long setæ on basal segment. Hind wings with two oblique veins and three hooklets. Length of body, 2.5 millimeters; antenna, 0.854; length of third antennal segment, 0.254; width of third antennal segment, 0.05; seta on antenna, 0.095; diameter of cornicle, 0.046; length of hind tibia, 1.18; width of hind tibia about middle, about 0.075; dorsal seta on head, 0.102.

Host.—Miscanthus sp.?

Habitat.—Sankakuho (altitude about 7,000 feet), Taichu Prefecture.

The single specimen found by me on the leaf of *Miscanthus*, August 11, 1936, is probably the winged form of *Tetraneura radicicola* Strand, hitherto unknown, and is described under that name. This species is characterized by many long setæ on the antennæ and legs, and by the large body.

MYZOCALLIS KURICOLA Matsumura.

Nippocallis kuricola MATSUMURA, Journ. Coll. Agr. Saporo 7 (1917) 365.

Host.—*Quercus serrata* Thunb.

Habitat.—Taihoku.

A few winged viviparous females, many apterous oviparous females, and a few alate males were found by me on a single host tree late in November, 1936. Known from Japan, Korea, and China.

The type specimens of the new species described in this paper are in the collection of the Department of Agriculture, Government Research Institute, Formosa.

ILLUSTRATIONS

TEXT FIGURES

FIG. 1. *Macrosiphum euryæ* sp. nov., wingless viviparous female; head, cornicle, and cauda.

2. *Acyrthosiphon rhododendri* sp. nov., wingless viviparous female; head, cauda, and cornicle.

3. *Aphis arundinariæ* sp. nov., winged viviparous female; head and cauda.

THE ODONATA OF THE PHILIPPINES

By James G. Needham and May K. Gyger
Of Cornell University, Ithaca

TEN PLATES AND TWO TEXT FIGURES

This is an illustrated account of the known dragon-fly fauna of the Philippine Islands. Dragon flies are interesting insects, and none anywhere are more interesting or more beautiful than those of these Islands. They are still very insufficiently known, as little collecting has been done except in a few places. We have described a few new species and have illustrated the immature stages of many others. We hope that by bringing together in a single paper diagnostic descriptions of all the known species we are preparing the way for further work in the Islands, where alone their biology can be effectively studied.

It is mostly pioneer descriptive work that has been done on Philippine Odonata hitherto, and among the workers two names stand preëminent—Friedrich Brauer and Edmond de Sélys Longchamps. In 1868 Brauer made the largest single contribution to the knowledge of the odonate fauna.[1] In this and in several earlier papers appearing in the publications of the same society he described some twenty-nine Philippine species; also, such characteristic genera as *Brachythemis, Diplacina, Lyriothemis, Onychothemis, Trithemis, Tetrathemis,* and *Urothemis.* Some widely ranging Philippine species were described by earlier authors from other lands, in widely scattered publications: Five species by Fabricius, two each by Drury and Burmeister, seven by Rambur, a few by Dr. H. Hagen, and some by Baron de Sélys.

In 1882 de Sélys published a list [2] in which he recorded seventy-seven species (nine of them new), and in the same journal in 1891 he published a supplement to the list, adding seven species, extended notes on local distribution, and a few redescriptions. De Sélys described in all twenty-three Philippine species.

[1] Neue und wenig bekannte von Herrn Doct. Semper gesammelte Odonaten, Abhandl. der k.k. zool.-bot. Ges. Wien 18 (1868) 167–188.

[2] Odonates des Philippines, An. Soc. Esp. Hist. Nat. 11 (1882) 1–32, 1 pl.

There are few other papers dealing with the Philippine odonate fauna. Besides those by Brauer and de Sélys cited above, there are a few more recent ones. [3]

The materials for this monograph have come from but few localities, principally the region about Manila, Luzon, and about Zamboanga, Mindanao. They came in the largest measure from Los Baños, and from nearby Molawin Creek and the slopes of Mount Maquiling. Dean C. F. Baker in his time gathered a great many adult dragon flies. He occasionally sent us interesting material for naming, and since his death much more collected by him has been loaned us for study. Dr. L. B. Uichanco has continued the good work of collecting Odonata, and he and his entomological students have sent us much valuable alcoholic material, including the immature stages of many species and genera. This is a good illustration of what the mere saving and sending to specialists of the specimens gathered by field classes of students in the course of their routine collecting may do to increase zoölogical knowledge in regions where little has been done on a local fauna.

From Mr. Fred C. Hadden, formerly of the Hawaiian Sugar Planters' Association Experiment Station and living at the College of Agriculture, also came much valuable material, both adults and nymphs. Molawin Creek and its environs furnished much of this. We are indebted to Mr. Hadden also for contact with Mr. H. C. Muzzall, who gathered for us a goodly lot of material, both nymphs and adults, about Kabasalan, Zamboanga, Mindanao.

We are indebted deeply to the late Mr. R. C. McGregor, formerly of the Bureau of Science, Manila, and for many years editor of the Philippine Journal of Science, both for specimens and for encouragement in the preparation of this monograph. His collections of adult dragon flies were made mainly in the lowlands about Manila (in part with the help of Andres Celestino, Francisco Rivera, and Anacleto Duyag), but he sent some material collected earlier in Samar—a wet island "that will stand a lot more field work."

[3] Ris, H., Sauter's Formosa-Ausbeute: Odonata, Suppl. Ent. 5 (1916) 1–80, figs. Laidlaw, Notes on Oriental dragonflies, with descriptions of new species, Proc. Zool. Soc. Lond. (1928) 129–138, figs. Ris, Vier neue Calopterygiden (Odonata) von den Philippinen und Palawan, Mitth. Münchener Ent. Ges. 20 (1930) 70–92, figs. Cowley, Descriptions of three new species of Drepanosticta (Odonata) from the Philippine Islands, Trans. Ent. Soc. Lond. 85 (1936) 157–67, figs.

The first few specimens of dragon-fly nymphs known to have come from the Philippine Islands were sent the senior author by his former pupil, Mr. C. F. Carstens, who was among the shipload of teachers sent to the Islands by the United States Government in 1898 on the army transport *Thomas*.

There appear to be but few Philippine Odonata in American museums. Through the kindness of Dr. Harold Morrison we have been loaned those of the United States National Museum, collected by Prof. C. F. Baker in Luzon, and a few that were collected by Dr. W. Dwight Pierce in Negros. We have also seen a few specimens from Mindanao in the Carnegie Museum at Pittsburg. A few additional specimens in the Ledyard collection at Stanford University were loaned us for study by Prof. G. F. Ferris. These also came from the vicinity of Los Baños. Doctor Pongrácz loaned us a few specimens from the collections of the Hungarian National Museum, among which was one of the two Philippine specimens of *Camacinia* that we have seen.

On the basis of this material we have prepared the following account of the odonate fauna of the Islands, fully realizing that the resources in this order are still largely unexplored. As a first contribution to the knowledge of the immature stages it is significant material, for the nymphs of such remarkable genera as *Mesogomphus, Tetracanthagyna, Idionyx, Tetrathemis,* and *Diplacina,* here described for the first time, add facts that must be taken into account in the final classification of the order. The extraordinary nymph of *Heteronaias heterodoxa* Sélys shows at a glance how mistakenly this species has hitherto been placed in such genera as *Epitheca, Somatochlora,* and *Procordulia.*

The nymphs of most Philippine species are still unknown. Here is an open field awaiting the local student. In order to facilitate his work we have provided keys and tables, as well as descriptions and figures. The keys will help to find names quickly, and the verification tables that follow them will enable him to know whether the keys with their unfamiliar terminology have led him aright. This combination of keys and tables has proved elsewhere a great aid to identification.

In order that the reader may be able to interpret the special terms used in descriptions, keys, and tables, certain figures in the plates show detailed parts explained in the list of illustrations. The armature of the nymphal labium is shown in Plate 9, figs. 110 and 112; that of the nymphal abdomen in Plate 9, fig. 107. The grasping organs of the adult male abdomen are named in Plate 1, figs. 6 and 8; the genital armature of the adult

female, in Plate 1, fig. 14. Arabic numerals indicate the respective abdominal segments. There are always ten of these segments; counting them is easiest from the tip backward.

Wing venation presents so many characters useful in the study of the Odonata that we figure it in text figure 1. Venational characters offer certain advantages of definiteness, clearness, and ease of observation. A few minutes' study of this figure, followed by half an hour's use of the keys and tables with wings of several types in hand, should enable anyone to master these terms sufficiently for generic determination.

Suborder ANISOPTERA

Dragon flies proper. Adults with wings held horizontally in repose, the hind wings broader than the fore.

Nymphs stout-bodied with a wide abdomen containing an internal rectal gill chamber, within which are the tracheal gills.

Below is a list of the Philippine anisopterous Odonata now known to us, with indications of known nymphs. Those marked with an asterisk are newly described in the following pages; those previously described from other lands are marked with a dagger.

CORDULEGASTERIDÆ

Orogomphus splendidus Sélys.

GOMPHIDÆ

Ictinogomphus tenax Sélys.
* *Gomphidia kirschii* Sélys.
* *Mesogomphus balneorum* sp. nov.
Leptogomphus semperi Sélys.
* *Heliogomphus bakeri* Laidlaw.

ÆSCHNIDÆ

Oligoæschna pœciloptera Karsch.
Oligoæschna zambo sp. nov.
Anaciæschna jaspidea Burmeister.
Anax julius Brauer.
† *Anax guttatus* Burmeister.
Anax gibbosulus Rambur.
Indæschna baluga sp. nov.
Gynacantha basiguttata Sélys.
Gynacantha subinterrupta Rambur.
† *Gynacantha hyalina* Sélys.
Gynacantha bayadera Sélys.
* *Tetracanthagyna bakeri* Campion.

LIBELLULIDÆ

MACROMIINÆ

† *Epophthalmia elegans* Brauer.
Macromia negrito sp. nov.
Macromia gerstaeckeri Krüger?
Macromidia samal sp. nov.

CORDULIINÆ

Idiophya salva sp. nov.
* *Idionyx philippa* Ris.
* *Heteronaias heterodoxa* Sélys.
† *Hemicordulia mindana* sp. nov.

LIBELLULINÆ

Orchithemis pulcherrima Brauer.
Agrionoptera quatuornotata Brauer.
Agrionoptera bartola sp. nov.
Nannophya pygmæa Rambur.
* *Tetrathemis irregularis* Brauer.
Diplacodes nebulosa Fabricius.
† *Diplacodes trivialis* Fabricius.
Raphismia bispina Hagen.
Zygonyx ida Karsch.

† *Acisoma panorpoides* Rambur.
Diplacina nana Brauer.
* *Diplacina braueri* Sélys.
* *Diplacina bolivari* Sélys.
† *Brachydiplax chalybea* Brauer.
Brachydiplax duivenbodei Brauer.
Macrodiplax cora Brauer.
Urothemis bisignata Brauer.
Zyxomma petiolatum Rambur.
Zyxomma obtusum Sélys.
* *Tholymis tillarga* Fabricius.
Rhyothemis phyllis Sulzer.
* *Neurothemis terminata* Ris.
Neurothemis palliata Rambur.
Camacinia gigantea Brauer.
† *Tramea limbata* Desjardins.
† *Hydrobasileus croceus* Brauer.
† *Pantala flavescens* Fabricius.
Orthetrum glaucum Brauer.
Orthetrum luzonicum Brauer.
† *Orthetrum sabina* Drury.
Orthetrum clelia Sélys.
Orthetrum testaceum Burmeister.
Lathrecista asiatica Fabricius.
Potamarcha obscura Rambur.
Onychothemis abnormis Brauer.
† *Trithemis aurora* Burmeister.
Trithemis pallidinervis Kirby.
Trithemis festiva Rambur.
† *Brachythemis contaminata* Fabricius.
Cratilla metallica Brauer.
Cratilla lineata Brauer.
† *Lyriothemis cleis* Brauer.
Lyriothemis latro sp. nov.
† *Crocothemis servilia* Drury.

Key to the families of Philippine Anisoptera.

ADULTS

1. Triangles of fore and hind wings similar in form and in distance from the arculus ..... 2.
   Triangles of fore and hind wings different; that of forewing pointed rearward; that of the hind wing elongated lengthwise of the wing and nearer to arculus ..... LIBELLULIDÆ.
2. Eyes far apart on top of head ..... GOMPHIDÆ.
   Eyes scarcely meeting on top of head ..... CORDULEGASTERIDÆ.
   Eyes broadly meeting on top of head ..... ÆSCHNIDÆ.

NYMPHS

1. Labium flat or nearly so ..... 2.
   Labium spoon-shaped, covering face up to eyes ..... 3.
2. Fore and middle tarsi 2-jointed; third joint of antennæ greatly enlarged ..... GOMPHIDÆ.
   Fore and middle tarsi 3-jointed; third joint of antennæ not greatly enlarged ..... ÆSCHNIDÆ.
3. Median lobe of labium bifid at apex; female nymph with an ovipositor ..... CORDULEGASTERIDÆ.
   Median lobe of labium entire at apex; female nymph with no ovipositor. LIBELLULIDÆ.

CORDULEGASTERIDÆ

Genus OROGOMPHUS Sélys

This family and genus are represented in the Philippines by one fine rare species of which no specimens have been before us. The following descriptions and figures, therefore, are copied. The portion of the hind wing shown in Plate 3, fig. 49, is quite adequate for its recognition.

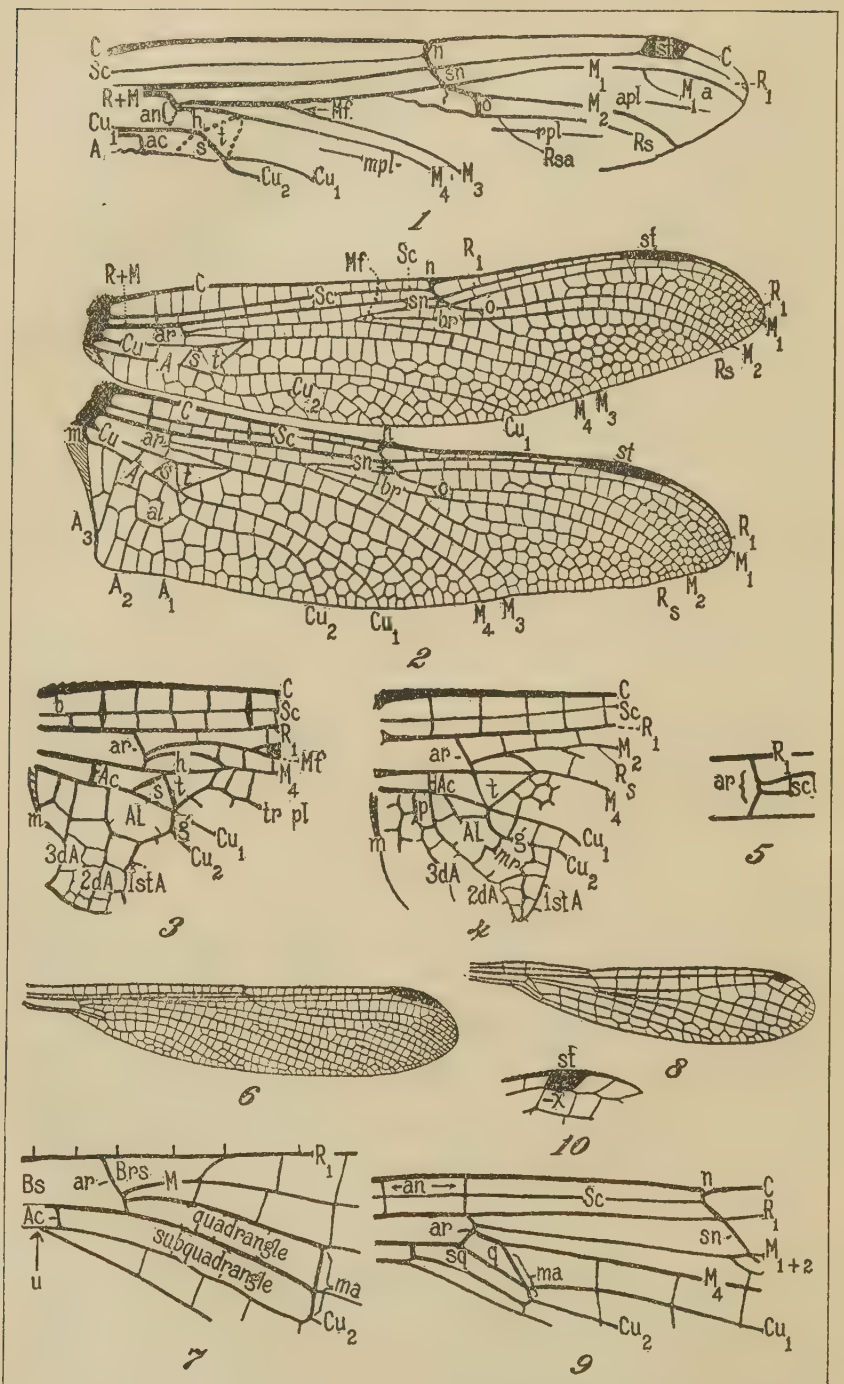

FIG. 1. Diagrams of venational characters of anisopterous wings. *1*, Diagram of the principal veins and their connections; *2*, *Cordulegaster savi*, wings; *3*, gomphine wing base, male; *4*, libelluline wing base; *5*, arculus and its sectors (M_{1-3} M_3); *6*, *Cyanocharis valga*, forewing; *7*, *Caliphæa consimilis*, part of wing base; *8*, *Telebasis salva*, forewing; *9*, *Telebasis salva*, part of wing base; *10*, *Anomalagrion hastatum*, stigma, female with brace vein *x*.

The nymphs in this family are elongate and hairy, with the body sagged in the middle and upcurved to head and tail. Superficially they resemble the nymphs of *Libellula,* having similar high-peaked eyes and squarish head, but the labium, although spoon-shaped, is very different, having a cleft in the apex of the median lobe and having the teeth on the lateral lobes deeply cut and very irregular.

OROGOMPHUS SPLENDIDUS Sélys. Plate 1, figs. 6 and 7; Plate 3, figs. 49 and 50.

SÉLYS, Bull. Acad. Belg. II 46 (1878) 681, female, Luzon; An. Soc. Esp. Hist. Nat. 11 (1882) 16; MARTIN, Mission Pavie Zool. (1904) 14, female, Tonkin; WILLIAMSON, Proc. U. S. Nat. Mus. 33 (1908) 277; RIS, Suppl. Ent. 1 (1912) 77–79, figs., male, Formosa; LAIDLAW, Proc. Zoöl. Soc. London 1 (1914) 60–61, pl. 1, fig. 8; Journ. Fed. Malay States Mus. 16 (1931) 235, (?) Borneo.

Male, abdomen, 55 mm; hind wing, 47.

Female, abdomen, 58 mm; hind wing, 49.

Female.—Head shining black, except for the clypeus, which forms a lemon-colored band marked with two impressed spots, and the crest of the front, which is narrowly yellowish. Eyes very slightly separate from each other; black hairs on the crest of the front, on the vertex, and on the occiput.

Thorax with an antehumeral streak, a juxtahumeral and lateral bands of yellow.

Abdomen much longer than the wings, enlarged in segments 1, 2, 8, and 9, black, without visible pattern, except a narrow terminal circle on segments 1 and 2 and yellow median lateral stripes on the same segments, that of the second rising in a narrow circle to the dorsal ridge. Anal appendages slender, cylindrical, blunt, shorter than segment 10, separated by a protuberance which ends the abdomen. Vulvar plate large, short, seemingly followed in an excavation by rudimentary lamellæ.

Legs black, the interior of the two first femora yellow at their base. Femora finely denticulate. Spines of the tibia moderately long. (From the original description.)

Male.—Labrum reddish brown. Rest of the head black, except for two yellow crossbands, one above the postclypeus with two dark impressed spots and a very small dark border on the sides, one above the top of the frons to the side margins of the flattened area.

Thorax black, marked with light yellow, as in Plate 3, fig. 50. Legs black. First pair of femora yellowish on the inside at the base.

Abdomen black, marked with yellow as follows: Two lateral spots and a cross stripe on the basal border of segment 1; a lateral border band, widened over the auricles, back to a complete ring very slightly interrupted in the middle, and two very small cross flecks on the cross margin on segment 2; on the lateral border a comparatively wider longitudinal stripe to the cross margin, fine cross streaks and a dorsal apical double spot on the cross margin on segment 3; segments 4 to 6 with only dorsal apical successive small double spots; 7 with a terminal half ring, about one-fifth the length of the segment in the middle and about one-half on the sides; 8 to 10 entirely black. Anal appendages black (Plate 1, figs. 6 and 7). (From the description in Ris. Figures from Ris.)

The nymph of this species is unknown, but Fraser has described and figured the nymphs of two Indian species, *O. atkinsoni* [4] and *O. campioni*.[5] From these sources we have drawn the characters stated in the preceding keys and tables. These will be sufficient for the recognition of the nymphs of *Orogomphus*.

GOMPHIDÆ

Key to the genera.

ADULTS

1. Triangles with crossveins; anal loop of four to six cells..... 2.
   Triangles open; anal loop of fewer cells or wanting..... 3.
2. A leaflike lateral expansion on segment 8..... *Ictinogomphus.*
   No such expansion on segment 8 ..... *Gomphidia.*
3. Median fork askew forward; median crossveins in hind wing 4 or 5.... 4.
   Median fork symmetrical; median crossveins in hind wing 1 or 2. *Mesogomphus.*
4. Basal subcostal crossvein present; male appendages straight. *Leptogomphus.*
   Basal subcostal crossvein absent; male appendages lyrate. *Heliogomphus.*

NYMPHS

1. Tarsi 2- 2- 2-jointed ..... 2.
   Tarsi 2- 2- 3-jointed ..... 3.
2. Two large teeth between the bases of the antennæ; abdomen almost circular when viewed from above; body opaque..... *Gomphidia.*
   No teeth between antennæ; abdomen elongate; body in life translucent. *Ictinogomphus.*
3. Third joint of antennæ very broad and flat..... *Heliogomphus.*
   Third joint of antennæ cylindrical ..... *Mesogomphus.*

[4] Mem. Dept. Agr. India Ent. Ser. 8 (1923) 29–30, fig. 1, A, B.
[5] Rec. Ind. Mus. 27 (1925) 423–429, pl. 10.

ICTINOGOMPHUS TENAX Sélys. Plate 3, fig. 51.

SÉLYS, Bull. Acad. Belg. II 21 (1854) 88, male, Manila; Monogr. Gomph. (1857) 269; Bull. Acad. Belg. II 46 (1878) 85, female; WILLIAMSON, Proc. U. S. Nat. Mus. 33 (1908) 278; SCHMIDT, Archiv f. Hydrobiol. Suppl. 13 (1934) 355–360, figs. 59–61.

Of this fine large species, known in the male sex since 1854, and recently recharacterized by Erich Schmidt, the female has been until now unknown. (The one of unknown source that was doubtfully associated by de Sélys with his male type probably does not belong with it. The likeness in arrangement of the weak crossveins within the triangle of the forewing is not significant, for these are variable, and there are differences in coloration other than those mentioned by de Sélys.) The presence of a pair in the material from Los Baños enables us to describe this sex from a Philippine specimen.

Female, allotype, length, 75 mm; abdomen, 53; hind wing, 42.

A robust black species, conspicuously striped with yellow on head and thorax and spotted with reddish yellow on the abdomen. Face black, crossbanded with yellow on the prominence of the frons, on the lower part of the postclypeus, and on the labium. On the labium divided in the middle and reduced at the ends to a pair of roundish spots. Clypeal stripe dilated at the ends. Labium and mandibles externally yellow. The black on top of the frons invades the yellow in an advancing triangle, almost dividing it in the middle. Vertex wholly black, with a sharply conical process arising behind each lateral ocellus. Occiput black, with a large oval spot of yellow occupying its central area, and with its hind margin fringed with tawny hairs and elevated in a pair of triangular processes. (These are similar to those of the female of *I. melænops* as figured by Schmidt [6] but larger.)

Prothorax blackish. Mesothoracic collar yellow, this color narrowly interrupted by the lower end of the black carina. Sulcus and hind margins of the antealar sinus yellow. Antehumeral yellow stripes divergent, isolated, narrowed and abbreviated below. All of the four additional yellow side stripes are isolated by black both above and below. The fourth is widest and semilunar, the second is wide and parallel-sided, the first and third are narrow and irregular, dilated at the uppermost end and somewhat constricted below it (Plate 3, fig. 51). Coxæ and stripes of the femora yellow; legs elsewhere black.

[6] Archiv f. Hydrobiol. Suppl. 13 (1934) 357, fig. 57*b*.

Wings subhyaline with black veins and stigma and with a distinct tinge of brown in the basal subcostal and cubital spaces. Twelve postnodal crossveins of the forewing.

Abdomen very moderately swollen at base, still less on terminal segments, and with the leaflike lateral expansion of segment 8 so narrow as to be hardly observable. Dorsum of segment 2 bears a median stripe of yellow, constricted towards the posterior end. This is followed by larger, broader, basal, double, reddish yellow spots on 3 to 7, becoming shorter and more deeply divided posteriorly, well separated and lateral on 8 and 9, small on 9. The sides of segments 1 to 3 are washed with yellow below; remainder of abdomen and appendages deep black (Plate 1, fig. 1).

LUZON, Laguna Province, Los Baños, female allotype, August 5, 1930 (*F. Bernardo*), female, August 25, 1925 (*A. de la Cruz*), male, no date or collector.

The left forewing of the second female alone has the triangle divided as described by de Sélys for the type: "Les deux veines du triangle des superieurs non confluentes."

GOMPHIDIA KIRSCHII Sélys. Plate 1, figs. 4 and 5; Plate 3, fig. 53.

SÉLYS, Bull. Acad. Belg. II 46 (1878) 81–83, male, female, Luzon, Mindanao; An. Soc. Esp. Hist. Nat. 11 (1882) 16; MARTIN, Mission Pavie Zool. (1904) 14, Philippines, Borneo, Tonkin; WILLIAMSON, Proc. U. S. Nat. Mus. 33 (1908) 281; LAIDLAW, Proc. Zoöl. Soc. London 1 (1914) 53; Part III (1920) 317 (*"karschi"*); Trans. Ent. Soc. London 78 (1930) 178.

Male, abdomen, 48 mm; hind wing, 38.

Female, abdomen, 45 mm; hind wing, 42.

Black, marked with saffron yellow.

Labrum yellow, largely bordered and traversed with black; anteclypeus yellow; clypeus black with a large yellow spot on the lateral lobes; front yellow and having above a large basal black spot prolonged in a cone in the middle and rejoining a large transverse anterior band of the same color, surmounting the clypeus. Top of the head black as well as the back of the eyes.

Thorax black, marked with yellow as follows: A mesothoracic half collar, interrupted on the back; an oblique cuneiform antehumeral band separated from the sinus and not touching the half collar (and sometimes a little superior humeral spot almost touching this band). On the sides a band under the front wing, another larger band under the hind wing, and a series of two

or three spots placed in the black intermediary space (Plate 3, fig. 53).

Abdomen black, marked with yellow as follows: A large lateral inferior band on the first two segments; a dorsal spot on the second, slendered and pointed towards the tip, which it does not touch; an elongate lateral spot which occupies the basal third of segments 3 to 7, that of segment 8 prolonged towards the base in a half circle; 9 and 10 black. No leaflike expansions of segment 8.

Legs robust, very short, interior of the anterior femora yellowish, as also a touch on the posterior.

Male.—Lamina of the occiput straight. Anal appendages blackish; the superior longer than the last segment, subcylindrical, slender, almost straight; inferiors one quarter as long as the superiors, forked (Plate 1, figs. 4 and 5).

Female.—Lamina of the occiput black or with a pale spot, briefly ciliated, elevated in the middle, the superior border of this elevation truncate, straight. Anal appendages black, conical, pointed, as long as the last segment (1 and 0.5 mm). Vulvar scale as long as segment 9, divided almost halfway into two leaves by a deep cut. (From the original description.)

LUZON, Laguna Province, Los Baños, male, February 7, 1919 (*S. G. Yap*), male, July 3, 1921 (*Sueco*), male, August 25, 1926 (*S. M. Cendaña*), female, February 23, 1930 (*S. M. Cendaña*), female, June 19, 1930 (*D. Tan*), female, July 5, 1930 (*J. Calacala*).

GOMPHIDIA KIRSCHII (?) Nymph. Plate 10, figs. 129 and 130.

Length, 24 mm; abdomen, 16; hind femur, 7; width of head, 8; width of abdomen, 12.

This is a very short and stocky nymph. Head widest across the eyes where the eyes project a little beyond the roundly bulging hind angles. Before them the frontal area is flat. On the front margin of it, between the bulging bases of the antennæ, a pair of blunt spiniferous teeth project forward, overhanging the mouth, and outside the antennal bases the projecting convex margins are armed with recurved prickles intermixed with hairs. Antennæ 4-jointed, the fourth exceedingly minute, the third long, cylindric, and hairy. The broadly convex rear of the head is covered by five large scars, the median one bare, the adjacent pair divided in its anterior half by a blackish line of scurfy pubescence, the larger lateral pair traversed by marmorate lines

of the same. Labium (Plate 10, fig. 129) very short, its hinge reaching backward only to the mesothorax; its lateral lobes small and set well in from the sides of the mentum. The movable hook is rather short and stout; the end hook half as long, rather blunt at the tip, and very finely denticulate along the middle portion of its inner margin. The broad mentum is hardly as long as wide, median lobe small, its slight convexity is hidden in a dense brush of hairs. The outer margin of the mentum is beset with flattened and serrately arranged spinules that suddenly increase in size at the sharp anterolateral angles.

Prothorax short and wide, the ends of its disc roundly projecting above a similar equally flat supracoxal process. Legs short and stout; femora and tibiæ twice faintly ringed with brown, and lined with bare strips separating strips of blackish prickles. The anterior face of each femur bears at its tip a flange that projects scalelike over the base of the tibia, that of the forelegs being largest—a protective device for the legs of a lotic species. The wing cases reach to the tip of abdominal segment 6.

Abdomen broadly oval, blunt at tip, triquetral in cross section, being high-ridged middorsally, and humped upward on segment 7. Stout, triangular, subequal spines terminate the lateral margins of segments 7 to 10, those of 7 a little divergent. Dorsal hooks on 4 to 9, isolated on 4, mere prolongations of the median ridge on 5 to 9, largest on 7. Segment 10 wholly recessed within 9 on the ventral side, but exposed on the dorsal for a length slightly greater than that of the stout appendages. Superior appendage triangular, a little longer than wide, a little shorter than the inferiors and like them blunt-tipped. Laterals slenderer, sharp-pointed, and a little shorter.

The reference of these nymphs to *G. kirschii* is based on the common occurrence of nymphs and adults, each of a single species, in Molawin Creek, Los Baños. That they belong to *Gomphidia* is certain since the rearing by Doctor Lew of *Ictinogomphus* (= *Ictinus*) *clavatus* (genus formerly confused with *Gomphidia*) at Peiping, China.[7]

Luzon, Laguna Province, Los Baños, 4 nymphs, April 1, 1927 (*L. B. Uichanco*); Molawin Creek, 3 nymphs, June 18, 1930 (*S. M. Cendaña*), Molawin Creek, Mount Maquiling at 200 feet, 3 nymphs (2 and a cast skin), April 9, 1932, no collector.

[7] Peking Nat. Hist. Bull. 6 (1931) 1.

MESOGOMPHUS BALNEORUM sp. nov. Plate 1, figs. 8, 11, and 12; Plate 3, figs. 46 and 55.

Male, hind wing 28 mm; abdomen, 33; appendage, 4.

Colors deep black and yellow. Face yellow, broadly cross-striped with black. Labrum yellow in the middle, a broad band along its basal suture, a little dilated downward in the middle, only slightly invading the yellow, and a narrow one around its free border. An arcuate band borders the postclypeus in front, its ends conjoined with the black below at the basal angles of the labrum. Frons black in front except close to the postclypeal suture, shiny black above with a large transverse, oblong, yellow spot on each side. Vertex black with a faint yellow spot on the rear of the ocellar tubercle. Antennæ black, the basal segments ringed with paler. Occiput fuscous, its hind margin concave and nearly bare.

Prothorax black above with only a faint yellow spot on each side of the median lobe. Synthorax black, conspicuously marked with bright yellow. The collar cross stripe divided widely by black at the carina. Two oblong yellow antehumeral spots are divergent downward, and well isolated both above and below. A humeral stripe is represented by a triangular spot above and a narrow line below. There is a broad oblique yellow stripe under each wing, in the hinder one broader and subterminal, and in the black between these two stripes is a row of three spots, the middle one close behind the spiracle narrower (Plate 3, fig. 55).

Legs mostly black, only the sides of the femora yellow. Wings hyaline, faintly flavescent, with black veins including the costa (Plate 3, fig. 46). Stigma dark brown.

Abdomen black, marked with yellow. Dorsum of segment 1 about half covered by a broad apical triangle of yellow, followed on segment 2 by a yellow middorsal line. A double, diffuse, yellowish spot on the dorsa of segments 3 to 7, divided on the median line apically, becoming somewhat shortened and better defined rearward. Sides of segments 1 and 2 yellow inferiorly. On the sides of 8 and 9, just above the large leaf-like lateral expansion of those segments, a double, irregular yellow spot.

Appendages (Plate 1, figs. 11 and 12) black, the superior equal in length to segments 9 and 10, regularly tapered and decurved to their slender downwardly directed tips. Hamules as shown in Plate 1, fig. 8.

This species resembles *M. lindgreni* Fraser, from Darjeeling, India, in size, in the black costa, and in the male appendages, but differs in numerous details of coloration and especially in the form of the male inferior appendage.

LUZON, Laguna Province, Los Baños, 2 males, November 6, 1923, no collector.

MESOGOMPHUS sp. Nymph. Plate 10, figs. 125 and 126.

Male, length, 27 mm; abdomen, 13; hind femur, 3.5; width of head, 5.5; width of abdomen, 6.5.

Female, length, 26 mm; abdomen, 12; hind femur, 3.5; width of head, 5.5; width of abdomen, 6.5.

This is a smooth-bodied hairy-legged nymph with a lanceolate abdomen. Head widest across the middle where the large eyes cover most of the sides, scarcely narrowed behind them to the broadly rounded hind angles. Occipital margin deeply and widely concave; hairy before the eyes and across the frons. Antennæ rather long with the slender upturned fourth joint one-third as long as the cylindric third joint. Labium (Plate 10, fig. 126) short, its hinge reaching backward well upon the mesothorax. Mentum almost parallel-sided in its wider distal two-thirds with a very prominently arched middle lobe that bears a long and uniform fringe of stiff, flattened, bristles. Lateral lobes rather small with a short movable hook that is hardly as long as the outer margin of the lobe before its origin, and with a small end hook half as long as the movable one, smooth on its inner margin.

Prothorax rather large, its disc depressed with its rounded lateral margins little projecting, beneath these the straight-edged supracoxal process projects moderately. Wing cases divergent (possibly because in process of emergence), their tips reaching segment 5.

Abdomen lanceolate with something of a color pattern showing on the middle segments: A pair of submedian dashes on each segment and a patch of brownish scars farther out towards the lateral margin. Low dorsal hooks on segments 2 and 3, smaller on 8 and 9, and scarcely indicated on the intervening segments. Lateral spines on 3 to 9, sharp, similar in all but slightly increasing in size posteriorly. Appendages long, longer than 9, sharp, regularly tapering, all subequal in length.

LUZON, Laguna Province, 1 female nymph, January 27 to February 18, 1931, no collector; Molawin Creek, 1 male nymph, June 18, 1930 (*S. M. Cendaña*). These specimens may be of different species.

LEPTOGOMPHUS SEMPERI Sélys.

Sélys, 4. Addit. Synop. Gomph. (1878) 38, male, Mindanao; An. Soc. Esp. Hist. Nat. 11 (1882) 16; Martin, Mission Pavie Zoöl. (1904) 11, Philippines, Borneo, Tonkin; Williamson, Proc. U. S. Nat. Mus. 33 (1908) 292, fig. 17; Ris, Suppl. Ent. 1 (1912) 68; Laidlaw, Proc. Zoöl. Soc. London 1 (1914) 54; (1920) 317; Rec. Ind. Mus. 24 (1922) 378; Fraser, Journ. Bomb. Nat. Hist. Soc. 31 (1927) 883; Laidlaw, Trans. Ent. Soc. London 78 (1930) 179.

Male, abdomen, 39 mm; hind wing, 33.

Head grayish brown mixed with yellowish and blackish. Labrum and face obscure; top of front with a lemon yellow band traversed by a fine median prolongation in the excavation forming a T in joining the blackish part of the crest; vertex and occiput obscure; the latter little elevated, ciliated with brown, on the border a little divided in two festoons; the middle being excavated.

A median lemon-colored spot on the prothorax. Thorax short, probably obscure in front, the sides pale yellow. Irregular black spots, probably disposed in two bands on the sutures and not touching the base.

Abdomen long, slender, uniform, at the base a little constricted and lightly expanded on segments 8 and 9. Colors altered, probably blackish marked with yellow. The yellow seems to occupy in a dorsal band segments 1 and 2 and the auricles; on 3 to 6 a large basal half circle and a part of the dorsal ridge; on 7 and 8, the dorsal ridge in a more distinct fashion; finally the dorsal ridge of segment 9, but only at the base. Segment 10 is entirely obscure, a little shorter than 9.

Anal appendages yellowish, the superiors a little shorter than segment 10 (about 1 mm long); they are remote, slim, subcylindrical, straight, slightly thickened at the base, briefly bifid at the tip, which is obscure; the external point a little longer than the internal. The inferior border, seen in profile with a lens, shows a series of very small black teeth. The inferior appendage a little shorter, almost completely divided in two slender, conical branches a little recurved to a blunt obscure tip, slightly slanted on the outside, the branches having the same separation as the superiors.

Legs very short, yellowish, the tip of the femora obscure, the spines blackish, those on the femora on short tubercles.

(Description from the original, which was drawn from one very poorly preserved specimen.)

No specimens have been before us.

HELIOGOMPHUS BAKERI Laidlaw. Plate 1, figs. 9, 10, and 14; Plate 3, figs. 47 and 54.

LAIDLAW, Philip. Journ. Sci. 28 (1925) 560–562, male, Mount Maquiling, Luzon; Trans. Ent. Soc. Lond. 78 (1930) 182.

Male, abdomen, 33 to 39 mm; hind wing, 29 to 35.

Female, abdomen, 42 mm; hind wing, 39.

Female allotype.—Labium blackish with a diffuse yellowish U-shaped mark in the center and a large pale oval spot in each of the upper lateral corners. Genæ yellow. Anteclypeus yellow. Postclypeus blackish with a medium-sized quadrate pale spot in the center of each lateral border and a small median yellow spot on the lower border. Frons yellow with a goblet-shaped dark spot bisecting it medially. Lower part of vertex yellow except for triangles of blackish at the bases of the antennæ. Median part black. Top of vertex excavate and dull fuscous yellow. Occiput yellowish fuscous, concave on margin except for a very small median point.

Anterior lobe of prothorax yellow with anterior margin black. Median lobe black, broadly bordered laterally with pale yellow, which continues along the caudal border to a point just laterad of two medium-sized pale yellow spots, which almost join on the middorsal line. Posterior lobe black, with a heart-shaped yellow spot, which almost bisects it. Synthorax black on dorsum. Mesothoracic collar yellow, interrupted at the center and joined at the lateral extremities to the ends of the dorsal bands. Two very small conjoined yellow spots in the center of the black, which interrupts the collar. Laterad of the dorsal bands at their upper ends there is a roughly triangular yellow spot and at the lower end a very small touch of yellowish (the latter not always present). Sides pale yellow with a narrow dark stripe on each lateral suture—all joined narrowly dorsally and the first two joined more broadly ventrally. Legs blackish. Front and middle femora paler on the inside. Wings hyaline, very slightly flavescent towards the base. Veins, including costa, all black. Pterostigma yellow. Antenodals and postnodals 18 : 15 and 12 : 15 in fore and hind wing, respectively.

Abdomen black, marked with yellow as follows: A stripe of irregular width on segments 1 to 7; a small basal and a larger apical half ring on segment 1; lateral half of segment 1; a broad lateral band, broader on the basal than on the apical half on segment 2; lateral band on segment 3 broken into two, the basal half broader and better defined than the apical; a large basal, roughly triangular, lateral spot on segment 4; 5 missing; a similar but more nearly quadrate spot on 6; a ring covering

the basal fourth of 7; a basal dorsal spot, a basal lateral J-shaped spot, and an apical unciform spot on 8; a narrow apical half ring on 9; a dorsal apical border and median dorsal triangular spot on segment 10. Appendages brown at base, paler apically. Subgenital plate as shown in Plate 1, fig. 14.

Male.—Labrum yellow, narrowly bordered with black. Black along the clypeolabial suture extending downward in a broad median line almost bisecting the yellow of the labium. Anteclypeus yellow, with a dark band on its lower border interrupted at the middle and a dark round spot a little above the center. Postclypeus black with a small median yellow spot contiguous with the color of the anteclypeus and a very large triangular yellow spot on each side. Frons yellow with a broad black line bisecting it vertically. Vertex black with a transverse yellow band above the antennæ and below the paired ocelli. Occiput black, concave on rear margin.

Anterior lobe of prothorax yellow, narrowly bordered anteriorly with black. Median lobe black with a small round yellow spot on each side of the middorsal line, lateral borders broadly yellow. Posterior lobe black with a small posterior median dorsal yellow spot. Dorsum of thorax black marked with yellow as follows: Mesothoracic collar yellow, interrupted in the middle, joined at sides by the ends of the dorsal bands; at outer sides of these at the upper end a triangular spot and at the lower end a small streak. Sides yellow with a dark stripe on each lateral suture, all narrowly joined dorsally and the first and second joined ventrally (Plate 3, fig. 54). Venter yellow. Legs black, posterior femora touched basally with yellow on the inside. Wings hyaline, very slightly flavescent at extreme base (Plate 3, fig. 47). Veins, including costa, black. Stigma yellow-brown. Antenodals and postnodals 13:13 and 10:10 in fore and hind wings, respectively.

Abdomen black, marked with yellow as follows: A narrow line on dorsum of segments 1 to 7, widened to form a half ring on the apical half of segment 1 and somewhat widened on the apical half of 2; a spindle-shaped dorsal spot on the base of segment 8; a small lateral basal triangular spot on 5 and 6; a somewhat quadrate spot on the base of 7 and a more broadly triangular one on the base of 8; an apical lateral triangular spot on segment 7 and an L-shaped one on 8. Segments 9 and 10 entirely black. Superior anal appendages lyrate (Plate 1, figs. 9 and 10), with an ectolateral projection shortly before the point where they begin to curve inward, the tips curved upward,

yellow at the tips, shading gradually to black at the base. Inferior appendage black, with widely divaricate branches, slightly curved upward at tip.

LUZON, Laguna Province, Los Baños, 1 male, May, 1915 (*F. Otanes*), 1 female, February 29, 1932 (*C. Antenor*). NEGROS, Saravia, 1 male, December 4, 1929 (*W. D. Pierce 7*).

HELIOGOMPHUS BAKERI (?) Nymph. Plate 10, figs. 121 and 122.

Length, 25 mm; abdomen, 16; hind femur, 7; width of head, 6; width of abdomen, 13.

This is an elongate flattish nymph with broadly linear abdomen. Head widest behind the middle across the large and somewhat prominent eyes, regularly narrowed behind to the low hind angles. A forward projection of the frons forms a raised semicircular area between the bases of the antennæ. Third joint of antennæ a very broad thin pentagonal plate nearly as wide as long and as broad as the space between the compound eyes. Labium (Plate 10, fig. 121) rather short, its hinge reaching the mesothorax. Lateral lobes rather narrow, with short and blunt end hook and with irregularly and minutely dentate inner margin. Movable hook long and sharp, slightly longer than the lateral lobe. Median lobe rather prominent, regularly convex, with a lower row of peglike chitinous denticles, and along their upper side a line of stiff flattened hairs that are inclined upward. Mentum a little longer than wide at apex, widened from base to apex, its side margins smooth. At the sides of the labium on the undersurface of the head is a longitudinal ridge that rises in two projections, the anterior of which is visible from above in front of the eye.

Prothorax short, its dorsal disc somewhat crescentic with blunt scurfy-pubescent anterolateral angles. Below these angles a supracoxal process projects laterally as a squarish plate. Legs brown, concolorous, scurfy-pubescent except for the usual curved longitudinal bare lines on them. Femoral apical flanges well-developed on all legs. Wing cases reach the base of the sixth abdominal segment.

Abdomen rather flat, parallel-sided for most of its length, brown with a row of irregular pale spots each side of the middle segments. Lateral spines on segments 7 to 9, triangular, subequal, becoming spinulose-serrate to rearward on outer margin. Dorsal hooks on segments 2 to 9 low, ridgelike, increasing in length to rearward, on 9 reaching the apex of 10. Segment 10 annular, almost included in the apex of 9. Appendages short,

half as long as 9; laterals and superior equal but a little shorter than the inferiors.

Determined generically by nymphal wing venation.

LUZON, Laguna Province, 2 nymphs, January 27 to February 18, 1930, no collector; Los Baños, 1 nymph, June 18, 1930 (*S. M. Cendaña*); Molawin Creek, at 200 feet, 8 nymphs, June 9, 1932, no collector.

ÆSCHNIDÆ

Key to the regional genera.

ADULTS

1. Vein Rs simple ..... 2.
   Vein Rs forked ..... 3.
2. Two cell rows between veins M_1 and M_2 behind the stigma. *Oligoæschna.*
   Three cell rows between veins M_1 and M_2 behind the stigma. [*Linaæschna*].
3. Sectors of the arculus arising from its upper end, the base of the upper sector nearer to vein R than to the middle of the arculus. 4.
   Sectors lower on the arculus, the base of the upper nearer to the middle than to vein R_1 ..... 6.
4. Anal loop of two vertical cell rows; three cell rows in the terminal fork of Rs ..... *Anaciæschna.*
   Anal loop of three vertical cell rows; two cell rows in the terminal fork of Rs ..... 5.
5. With an extra lateral longitudinal carina on the middle abdominal segments, and with several bridge crossveins ..... *Anax.*
   With no extra lateral longitudinal carina on the middle abdominal segments, and with but a single bridge crossvein ..... [*Hemianax*].
6. With crossveins in the midbasal space ..... 7.
   With no crossveins in the midbasal space ..... 9.
7. Two cell rows between Cu_1 and Cu_2 where widest apart. [*Amphiæschna*].
   One cell row between Cu_1 and Cu_2 where widest apart ..... 8.
8. The median planate subtends four rows of cells ..... *Indæschna.*
   The median planate subtends one row of cells ..... [*Cephalæschna*].
9. Radial planate straight, subtending a single row of cells. [*Æschnophlebia*].
   Radial planate strongly sagged, subtending four or five cell rows ..... 10.
10. One cell row between veins Cu_1 and Cu_2 ..... *Gynacantha.*
    Two or three cell rows between veins Cu_1 and Cu_2 ..... *Tetracanthagyna.*

NYMPHS

1. With dorsal hooks on apical abdominal segments ..... *Tetracanthagyna.*
   No such dorsal hooks ..... 2.
2. With lateral spines on segments 7 to 9 ..... *Anax.*
   With lateral spines on segments 6 to 9 ..... *Gynacantha.*
   With lateral spines on segments 5 to 9 ..... *Amphiæschna?*

Names in the foregoing key that are inclosed in square brackets are of genera not yet recorded from the Philippines, but their species are strong-flying and the genera are of regional (mostly southward) distribution and likely to be represented in the Islands.

Verification table.

Genus.	Forewing.					Hind wing.	
	Cross-veins in midbasal space.	Brace vein to stigma.	M_4 turns—	Fork of Rs.	Cell rows subtended by radial planate.	Cubito-anal cross-veins.	Length.
							mm.
Æschnophlebia	No	No	Out [a]	Straight	1–2	3	44
Amphiæschna	Yes	No	Out	Variable	6	6–9	55–62
Anaciæschna	No	Yes	Up [b]	Sagged	4–5	3–4	42–46
Anax	No	Yes	Up	do	4–5	4–5	48–55
Cephalæschna	Yes	Yes	Out	Straight	1	4–5	41–44
Gynacantha	No	Yes	Out	Sagged	4–5	6–8	39–52
Hemianax	No	Yes	Up	do	4–5	4	45–46
Indæschna	Yes	No	Out	do	4–5	7–9	60
Linæschna	No	Yes	Out	None	1–2	2	53
Oligoæschna	No	Yes	Out	do	1	2	35–42
Tetracanthagyna	No	No	Out	Sagged	4	8	60–66

[a] That is M_4 is in its normal position. [b] M_4 apparently conjoined with M_3.

Genus OLIGOÆSCHNA Sélys

(=*Jagoria* Karsch)

In this primitive genus two species are represented in the collections before us, one of which has long been known and the other is new. The nymphs are unknown.

OLIGOÆSCHNA PŒCILOPTERA Karsch.

KARSCH, Ent. Nachr. 15 (1889) 238 (in *Jagoria*), Luzon; SÉLYS, An. Soc. Hist. Nat. Esp. 20 (1891) 212; MARTIN, Cat. Coll. Sélys 18 (1908) 130–132 (in *Jagoria*), Sumatra, Borneo.

A single female from Mati, Davao, Mindanao. Its wings are stained with brown deeply at the base, especially before the arculus, the color fading before the level of the nodus in the forewing and just beyond in the hind wing. Length of hind wing 42 mm.

OLIGOÆSCHNA ZAMBO sp. nov. Plate 2, figs. 33 and 34; Plate 3, fig. 48.

Length, 53 mm; abdomen, 49; hind wing, 38.

Entire face brownish olivaceous with a tinge of reddish. Top of frons and antennæ brown. Vertex and occiput black.

Synthorax brown, thinly clothed with blackish hairs, and with carina and crest somewhat paler. On the front a pair of ill-defined, antehumeral, pale streaks, divergent downward, and just above each of them an equally obscure, transverse, pale streak below the crest. On the sides are two broad and very diffuse yellowish streaks, one under each wing, overlaid on their opposed margins by some wavy lines of fuscous. Legs brownish at base, becoming black distally. Wings (Plate 3, fig. 48) subhyaline, tinged with yellow almost out to the triangles; veins and stigma brown. Ante- and postnodals 18 : 9 and 13 : 11 in fore and hind wings, respectively. First and sixth antenodals thickened.

Abdomen slender, inflated on the two basal segments, constricted on segment 3 then parallel-sided to 10, which is bulged upward and dome-shaped on the dorsal side. The color is brown with pale markings that cover the base of segment 1, most of the sides of 2, a transverse dorsal subapical band on 2 to 7, a lateral subbasal spot on 3 to 7, and an oblique streak beside the curving impressed line near the middle of each side on 3 to 6. Segments 1 and 2 hairy above.

Appendages (Plate 2, figs. 33 and 34) blackish, twice as long as segment 10, inferior nearly as long as the superiors, the latter flattened and dilated towards their obliquely truncate tips and armed on their interno-inferior margin with a row of denticles.

MINDANAO, Zamboanga Province, Kabasalan, 1 male, type, July, 1932 (*H. C. Muzzall;* Cornell University collection). Another male lacking the last four segments of the abdomen, same data.

This species is nearest *O. buhri*, from North Borneo, but differs markedly in the form of the male appendages, lacking the large basal inferior tooth of that species and having instead a row of several interno-inferior denticles on the superior appendage.

Genus ANACIÆSCHNA Sélys

This well-known, widely distributed Oriental genus appears not to have been reported hitherto from the Philippines. It is represented in our collections by the following species.

ANACIÆSCHNA JASPIDEA Burmeister.

BURMEISTER, Handb. Ent. 2 (1839) 840 (in *Æschna*); BRAUER, Reise d. Novara (1866) 63 (in *Anax*); SÉLYS, Mitth. Mus. Dresden 3 (1878) 317; MARTIN, Cat. Coll. Sélys 18 (1909) 30 (figs.); NEEDHAM, Bishop Mus. Bull. 113 (1932) 22 (fig.).

Hind wing, 42 to 46 mm.

This yellowish æschnine is easily recognized by the oblique brown stripe laid on the middle of the side of its yellow synthorax. Four specimens only are before us.

LUZON, Laguna Province, Mount Maquiling, 1 female (*Baker*); Los Baños, 1 female, February 28, 1934 (*Ramon Quilapio*), 1 male, November 21, 1934 (*B. Hollero*), altitude 50 meters, 1 female, November 22, 1934 (*Mateo R. Tibay*).

Genus ANAX Leach

This cosmopolitan genus is represented in the Philippines by three recorded species, two of which have been before us. They may be distinguished as follows:

1. Smaller; hind wing 50 mm or less..... *julius.*
   Larger; hind wing 51 mm or more..... 2.
2. Middle abdominal segments with three rather large pale spots. *guttatus.*
   Middle abdominal segments with but two smaller spots.... *gibbosulus.*

Anax julius is further distinguished by a blackish bar across the prominence of the frons, followed by one of blue; also, in the male, by the form of the abdominal appendages as shown in the figure. The dorsum of the abdomen is covered by a broad brown band, below which is a much interrupted band of paler on each side (often obscure in dried specimens).

Anax guttatus and *A. gibbosulus* are distinguished with difficulty, being of about equally large stature and similar and equally variable coloration. In both the brown color of the abdomen is extensive, the pale color of the sides being broken into smaller and well-segregated spots. *Anax guttatus* has the prominence of the frons pale, while *gibbosulus* has a brown stripe across it that is generally connected more or less broadly with the brown before the ocelli, forming a T-spot above.

The appendages of the male are typically a little heavier with a stouter apical tooth in *A. gibbosulus* (Plate 2, figs 21 and 22), and the undersurface is more nearly straight; but they appear differently according to the position in which they are viewed, and we are inclined to think that they alone will hardly serve to distinguish the two species. The same may be said concerning the form of the abdominal appendages of the female, which are typically more obtuse at the apex in *A. gibbosulus*. There is greater elongation and narrowing of abdominal segment 3, especially in the male, that is, enough for recognition in well-preserved specimens.

ANAX JULIUS Brauer. Plate 2, figs. 23 and 24.

BRAUER, Verh. zool.-bot. Ges. Wien 17 (1865) 508, Hongkong; Reise d. Novara, Neur. (1866) 61, 63; SÉLYS, C. R. Ent. Soc. Belg. 27 (1883) 116; MARTIN, Cat. Coll. Sélys 18 (1909) 21.

Japan, China, Formosa, Bengal.

Hind wing, 48 to 50 mm.

ANAX GUTTATUS Burmeister. Plate 2, figs. 25 and 26.

BURMEISTER, Handb. Neur. 2 (1839) 840 (in *Æschna*), male, female, Java; BRAUER, Reise d. Novara, Neur. (1866) 62; HAGEN, Verh. zool.-bot. Ges. Wien 17 (1867) 39; MARTIN, Cat. Coll. Sélys 18 (1909) 23; LIEFTINCK, Treubia 8 (1930) 328, Supplement.

East Indies, Seychelles Islands, Queensland.

Hind wing, 51 to 54 mm.

A nymph referred to this species by supposition was described and figured by the senior author.[8]

LUZON, Manila, 1 female, July 26 (*W. Schultze*), 1 male, November 3, 1933 (*Fortunato Guzman*), 1 male (*McGregor*): Laguna Province, Laguna, 1 male, May, 1932 (*Muzzall*); Los Baños, 1 female, February 21, 1925 (*F. Leus*), 1 female, February 23, 1930 (*Pangramuyen*), 1 female, August 2, 1930 (*F. Isidoro*), 1 female, September 6, 1930 (*C. Reyno*), 1 male, July 8, 1931 (*L. T. Viado*), 2 males (*Baker*). MINDANAO, Zamboanga Province, Kabasalan, 1 male (*Muzzall*).

ANAX GIBBOSULUS Rambur. Plate 2, figs. 21 and 22.

RAMBUR, Hist. Nat. Neuropt. (1842) 187, male, Australia; BRAUER, Reise d. Novara, Neur. (1866) 62; RIS, Libell. Bism. Arch. (1900); MARTIN, Cat. Coll. Sélys 18 (1909) 24.

Australia, Kei, New Guinea, Philippines.

Hind wing, 54 to 55 mm.

LUZON, Mountain Province, Benguet, 1 male and 1 female: Laguna Province, Los Baños(?), 1 male, no collector.

Genus INDÆSCHNA Fraser

Neither this genus nor *Amphiæschna*, from which it was separated by Fraser,[9] has been reported from the Philippines hitherto. We have the adult of a new species, closely allied to the type, *I. grubauri*, that is known from Malacca, Borneo, and Java. We describe it herewith and follow it with the description of a nymph that appears to belong in the allied genus *Amphiæschna* in so far as its developing venation can be seen.

[8] Proc. U. S. Nat. Mus. 27 (1904) 695, pl. 40, fig. 2.

[9] Treubia 8 (1926) 474.

INDÆSCHNA BALUGA sp. nov. Plate 2, figs. 31 and 32.

Length, 90 mm; abdomen, 65 (width, approximately 7); hind wing, 60.

This is a long-winged blackish species. Head wide, with eyes meeting in a seam that comprises half the length of the head. Face green, becoming blackish on the front of the frons, and hairy around the sides; labrum pale brown on its emarginate free border. Top of head all blackish. Antennæ reddish. Occiput deeply concave in the rear, bare, shining.

Synthorax blackish, clothed with brown pubescence, with obscure pale markings as follows: A pair of isolated cuneate antehumeral spots on the front, tapering and divergent downward; an oblique lateral band under each wing, ill-defined, the rear one more than twice as wide as the other and covering most of the metepimeron. Legs black beyond the knees, dark rufescent basally, long and nearly bare. Wings subhyaline, faintly tinged with amber, the latter color forming a number of faint clouds towards the rear margin. Veins and stigma dark brown. Ante- and postnodals 42:29 and 27:35, respectively, with the first and thirteenth or fourteenth thickened.

Abdomen blackish, paler on the sides of the two basal segments and with subapical paler rings on segments 3 to 7, widest on 3, very narrow on 7. Segments 8 to 10 black. The two basal segments hairy, especially on the dorsum, and a median carina on segment 1 is raised on the posterior half in a semicircular ridge that is densely hairy. Segment 10 bears a low middorsal ridge that is elevated in a tooth at one-third of its length that, viewed from the side, is a nearly equilateral triangle. Appendages as shown in Plate 2, figs. 31 and 32.

LUZON, Tayabas Province, Mount Banahao, elevation 975 meters, 1 male, type, May 20, 1933 (*A. Y. Coronel*).

This species is closely allied to *I. grubaueri* Förster, but seems to differ in lacking the brownish color along vein M_1 in having the metepimeron more extensively pale, in having a semicircular middorsal prominence on segment 1 of the abdomen (not mentioned, at least by Förster), in having the dorsal tooth on segment 10 smaller and more remote from the base, and in having the principal dilation of the superior appendages of the male narrower.

? AMPHIÆSCHNA sp. ? Nymph (supposition). Plate 10, figs. 119 and 120.

Length, 54 mm; abdomen, 39; hind femur, 12; width of head, 11; width of abdomen, 11.

This is an elongate smooth nymph with wide flat head and brown-ringed femora. Head widest across the broadly rounded eyes, and narrowed rather regularly behind them to the broadly truncate hind angles, between which the hind margin is roundly notched. Antennæ 6-jointed, the last joint very long, comprising nearly half the flagellum. Labium (Plate 10, fig. 120) rather broad and flat. Lateral lobes about as long as the regularly curved and tapering movable hook, truncate on the end which terminates the inner angle in a large prominent tooth, proximal to which on the inner margin a row of about fifteen minute denticles. Median lobe a little produced, with a narrow median cleft. At each side of the cleft a minute tooth almost hidden in a marginal fringe of hairs. The mentum is suddenly widened at two-fifths of its length and then again parallel-sided to the base of the lateral lobes, with margins spinulose-serrate.

Disc of prothorax almost semilunar, with the anterolateral ends of the crescent projecting. The supracoxal process bears a long middle tooth, a shorter and wider posterior one, and a low and inconspicuous anterior one. The synthorax is smooth, pale in color, streaked with darker brown. Legs smooth, of moderate length, with a brown ring on each femur.

Abdomen rather elongate, widest on segment 6, slowly tapering both ways. Lateral spines on 5 to 9 increasing in size posteriorly. No dorsal hooks, but a low middorsal ridge on the terminal segments terminating in a near-hook on 9. The relative lengths of segments 8, 9, and 10 as 10 : 8 : 6, and the appendages a trifle longer than 9. Superior appendage about equal to inferiors in length, both truncate on tip; laterals one-fourth shorter, incurved, and sharply pointed.

A single male nymph from Hamilton Lakes, March 25, 1930.

The following venational data derived from examination of the wings may aid in the determination of the species when corresponding adults are at hand. Ante- and postnodal crossveins 24: 15 and 17: 16 in fore and hind wings, respectively, with the first and ninth or tenth thickened. The fork of Rs appears to include four rows of cells. The radial planate is straight, not strongly sagged. The triangle of the hind wing is 4-celled, two of the cells on its proximal side, and the supratriangular space seems to be traversed by an unusually large number of crossveins, apparently seven or eight. The median planate of the hind wing subtends two or three cell rows. Between the branches of Cu there is but a single row of cells. The

anal loop appears elongate transversely to the axis of the wing, with but two vertical cell rows, and with another looped-up single row on its proximal side. In most of these characters this specimen seems to resemble *Amphiæschna* more closely than any other regional known genus. Unfortunately the basal part of the wings is not well preserved.

Genus GYNACANTHA Rambur

It is very difficult to distinguish some of the species of this genus. One who is familiar with them can recognize them fairly easily, but it is almost impossible to list any character or group of characters by which a single specimen may be determined with certainty. There is so much overlapping among some groups of species that they probably should be considered as mere varieties.

Gynacantha basiguttata should be easily separated from the other species in the Philippines by the red-brown spots in the wing bases and the tooth on the inner margin of the superior appendages of the male. *Gynacantha bayadera* is smaller than the others; dried specimens are more definitely green on face and thorax; the auricles are smaller; the anterior laminæ much smaller, paler in color, and with more curved spines; the superior appendages are more even in width, more nearly undulant in side view. *Gynacantha subinterrupta* is best differentiated from *hyalina* by the difference in proportion of the male appendages and the number of ante- and postnodal crossveins (see the descriptions). The wings of *subinterrupta* appear to be more closely and darkly veined than those of *hyalina,* which is scarcely borne out by the actual numbers of crossveins and cells. In *hyalina* the anal loop looks broader than in *subinterrupta,* and frequently consists of three rows of cells for its entire length; while the latter tapers to two rows at the lower end in all the specimens we have seen. The inter-alar sclerites and the ventral surface of the auricles in *hyalina* are very often the color of verdigris. The females of all these species resemble the males in general appearance; they have only vestiges of the auricles and are best identified by the number of nodal crossveins.

GYNACANTHA BASIGUTTATA Sélys. Plate 2, figs. 42 and 43.

SÉLYS, An. Soc. Esp. Hist. Nat. 11 (1882) 18, Luzon, Borneo; MARTIN, Cat. Coll. Sélys 20 (1909) 192, Philippines, Burma, Sunda Archipelago; FRASER, Treubia 8 (1926) 179 (*javica*), Java; LIEFTINCK, Treubia 12 (1930) 165.

Hind wing, male, 45 mm; female, 52.

Male.—Face olive-yellow, top of frons yellow with a thick black T. Thorax maroon or greenish brown. Legs black. Wings more or less yellowish with a red-brown mark at the base under the subcosta (sometimes extending above it) reaching to the first antenodal. Ante- and postnodals 26–30 : 22–23 in the front wings. Abdomen yellowish brown, extremely enlarged at the base and very much constricted in the third segment. Auricles very large. Superior appendages black, longer than the last two segments, very slender at the base and for about three-fourths of their length, somewhat widened and spatulate at the tip, with a tooth on the inner margins at the base. The inferior appendage about one-fifth the length of the superiors (Plate 2, figs. 42 and 43). (Description from Martin.)

GYNACANTHA SUBINTERRUPTA Rambur. Plate 2, figs. 35, 40, and 41.

RAMBUR, Hist. Nat. des Ins. Néuroptères (1842) 212, Java; MARTIN, Cat. Coll. Sélys 20 (1909) 193, Philippines, Burma, Sunda Archipelago.

Hind wing, male, 45 to 49 mm; female, 51.

Male.—Face yellowish; top of frons with a (usually) distinct, thick black T. Thorax dark olivaceous brown on the dorsum, shading to yellowish on sides. Legs reddish. Wings hyaline or slightly suffused with saffron, sometimes with small basal brown spots between Sc and R+M and Cu and A. Ante- and postnodals 26–31 : 22–27 and 19–23 : 24–27 in fore and hind wings, respectively. First segment of abdomen yellowish, bordered posteriorly with black. Auricles on segment 2 very large, narrowly bordered with black, with about six small, inwardly inclined teeth on the caudal border. Spine on the anterior lamina stout, nearly straight, scarcely tipped with brown (Plate 2, fig. 35). First two segments much enlarged; segment 3 much constricted, especially laterally; 4 to 7 moderately wide and about equal; 8 to 10 somewhat narrower. Superior appendages blackish, about equal in length to segments 8 and 9 together, relatively straight in lateral view; inferior appendage about one-fourth the length of the superiors, yellow, blackish at base and tipped with dark brown (Plate 2, figs. 40 and 41).

LUZON, Laguna Province, Los Baños, 1 male, May 25, 1923 (*D. Villadolid*); Mount Maquiling, 1 male (*Baker*). MINDANAO, Davao Province, Mati, 1 male and 1 female, April, 1927, no collector.

GYNACANTHA HYALINA Sélys. Plate 2, figs. 36, 38, and 39.

SÉLYS, An. Soc. Esp. Hist. Nat. 11 (1882) 17, male and female, Luzon; MARTIN, Cat. Coll. Sélys 20 (1909) 198, Philippines, Borneo, Tonkin, China, Japan, Burma.

Male, length of abdomen, 50 to 52 mm; hind wing, 40 to 47.

Female, length of abdomen, 52 to 56 mm; hind wing, 46 to 51.

Male.—Face yellowish, top of frons with a thick black T. Thorax brown with an olivaceous shade on the dorsum and yellowish brown on the sides. Legs reddish yellow. First segment of abdomen brown on dorsum. Segments 1 and 2 much swollen, 3 much constricted in the middle, 4 to 10 moderate and nearly equal in width. Auricles on segment 2 large, bordered with black and with about six small inward-pointing teeth on the posterior margin. Spine on the anterior lamina moderate, nearly straight, tipped with brown (Plate 2, fig 36). Superior appendages blackish, longer than segments 9 and 10 together, quite straight in lateral view. Inferior appendage yellow, brown at base and tip, about one-third the length of the superiors (Plate 2, figs. 38 and 39).

Wings hyaline or slightly saffron tinted, sometimes with a small brown spot between Sc and R+M and Cu and A. Forewing antenodals 22–28, postnodals 16–20. Hind wing antenodals 16–20, postnodals 18–23.

LUZON, Manila, 1 male, August 24, 1930 (*McGregor*) : Rizal Province, Novaliches, 1 female, April 26, 1930: Nueva Ecija Province, Gapan, 1 male, June 26, 1932 (*J. Ramos*) : Laguna Province, Mount Maquiling, 1 male (*Baker*) ; Los Baños, 1 male, August 2, 1932 (*M. Cortez*), 1 male, August 6, 1932 (*Felix Bauaug*), 1 female, October, 1930 (*Entomology 1 students*), 1 female, October 19, 1930 (*N. Bartolome*). PALAWAN, Taytay, 1 male, April 24, 1913 (*W. Schultze*).

GYNACANTHA BAYADERA Sélys. Plate 2, figs. 37, 44, and 45.

SÉLYS, Ann. Mus. Genov. II 10 (1891) 483, Bhamo, Sikkim; MARTIN, Cat. Coll. Sélys 20 (1909) 195, Burma, India, Sunda Archipelago, New Guinea.

Male, hind wing, 39 to 40 mm.

Female, hind wing, 39.5 mm.

Male.—Face olivaceous green, a faintly darker bar along the ridge of the frons but no T. Thorax dull, sometimes brownish, green. Abdomen brownish, somewhat enlarged in segments 1 and 2, constricted in the middle of 3, tapering slightly from 4 to 10. Auricles on segment 2 moderate with about five rather

strong inward-curving teeth on the posterior margin. Superior appendages longer than segments 9 and 10 together, almost equal in width from base to tip, slightly undulant in side view. Inferior appendage yellow, darkening to brown at the tip, about two-fifths as long as the superiors (Plate 2, figs. 44 and 45). Anterior laminæ pale yellow, rather short and broad at the base, the spines directed outward at first and then curving inward at the tips which are brown (Plate 2, fig. 37). Wings hyaline or shaded with saffron, sometimes with basal spots of brown between Sc and R+M and Cu and A. Ante- and postnodals 17–21 : 12–17 and 13–17 : 13–17 in fore and hind wings, respectively.

LUZON, Laguna Province, Los Baños, 1 female, October, 1930 (*G. Malabayabas*), 1 male, January 8, 1931 (*P. C. Gabertan*), 1 male, January 15, 1931 (*Melencio Agustin*) : Tayabas Province, Quezon Park, 1 male, May 8, 1931 (*F. Juan*). MINDANAO, Zamboanga Province, Kabasalan, 1 male, July, 1932 (*Muzzall*).

GYNACANTHA sp? Nymph. Plate 10, figs. 123 and 124.

The single nymph of this genus in the collection is apparently about half grown (length 22 mm). It is a broken specimen, hardly adequate for description. It will suffice here to point out the principal characters in which the nymphs of this genus differ from those of other known Philippine æschnine genera.

The eyes are broadly rounded and very large, covering more than half the length of the sides of the head. The labium (Plate 10, fig. 124) is armed with raptorial setæ in mixed array; two long strong ones on the lateral lobe near the base of the movable hook and about five weak and indistinct ones in a row more proximal; also three long ones on the movable hook intermixed with a number of weak shorter ones. The median lobe is produced and unarmed, but densely fringed with soft hairs, and its median cleft is tightly closed. The lateral lobe is very broad at its squarely truncate apex. The disc of the prothorax is unarmed. On the sides of the prothorax there are two subequal supracoxal processes. There are no dorsal hooks, and the short lateral spines on segments 6 to 9 increase in length posteriorly.

TETRACANTHAGYNA BAKERI Campion. Plate 2, figs. 27 to 30.

CAMPION, Proc. Zoöl. Soc. London No. 9 (1928) 129, male, Luzon.

Male, abdomen, 67.5 mm; hind wing, 60.
Female, abdomen, 60 mm; hind wing, 66.

Female.—Face pale yellowish brown. Ridge of frons black, this color shading back over the top of the frons. Vertex red-brown. Occipital triangle pale brownish yellow.

Pro- and synthorax light brown and entirely unmarked. Legs light reddish brown, tarsal claws blackish. Wings hyaline with small basal touches of brown in the costal and subcostal spaces. Costa yellowish, the rest of the venation dark brown and the lesser details extremely variable.

Abdomen reddish brown, shading to blackish at the tip. Appendages blackish brown, of the shape shown in Plate 2, figs. 27 and 28. This is the first description of the female.

Male.—Similar in coloration to the female. The additional length of the abdomen is due to the appendages (Plate 2, figs. 29 and 30).

LUZON, Laguna Province, Los Baños, 1 female, August 18, 1927 (*Pascual Matulac*), 1 male (locality ?); Mount Maquiling, 1 male and 2 females (*Baker*).

TETRACANTHAGYNA BAKERI Campion. Nymph. Plate 10, figs. 127 and 128.

Length, 55 mm; abdomen, 38; hind femur, 9; width of head, 10; width of abdomen, 10. (Measurements from a female nymph, apparently in the penultimate instar.)

This is an elongate short-legged nymph with tuberculate thorax and triquetral abdomen. Head widest across the rather narrowly projecting eyes, narrowed behind them, at first suddenly, then slowly to the backwardly projecting hind angles, sloping forward moderately to the front of the wide and narrow frons, then declivitous to the mouth. Antennæ pale, 7-jointed. Two pairs of prominent tubercles project from the sides of the head behind the eyes, one on the upper and one on each lower margin, two pairs of low wartlike submedian elevations on the dorsum. Rear of head deeply concave, sides irregularly rugose. Labium (Plate 10, fig. 128) very long, its hinge reaching the base of the middle legs. Lateral lobe short but with a long narrow end hook as long as its body, and with a very long and strong movable hook. The latter is twice as long as the end hook and of equal width at base. Median lobe bifid in two well-rounded hair-fringed curves that meet in an acute median notch. Mentum parallel-sided in its basal two-fifths, then greatly widened almost to the base of the lateral lobes, with the thin outer curving margins spinulose-serrate.

Prothoracic dorsum divided transversely into an anterior annular belt with raised front margin, and a wider, more or less

shield-shaped disc whose outer anterior angles project in a conspicuous nipple-shaped tubercle. At the sides the supracoxal plate bears a pair of similar tubercles projecting laterally, and a third one projecting forward beneath the lower lateral tubercle on the head. Spiracles black-lipped, bordered with paler. Sides of synthorax undulate with a number of low tubercles. Legs nearly bare, brown, obscurely ringed with blackish.

Abdomen long and narrow, widest on segment 7. Color pale brown, paler beneath, washed with darker brown towards the end and mottled indistinctly with the same color on the dorsum. Segments 5 to 10, with short thick lateral spines, increasing in length and stoutness posteriorly. Segments 7 or 8 to 10 with low short blunt dorsal hooks, largest on 9. Terminal segments diminishing slowly in length to rearward, 10 longer than the appendages. The superior appendage almost as long as the inferior and bearing on its basal half (male) or third (female) a middorsal projection similar to the dorsal hook on 10, beyond which the margin is serrate, as are all the margins of the superiors. The sides of these appendages beset with minute blackish prickles. The lateral appendages one-third as long as the others. Cerci short, stout, projecting conspicuously at the sides of the appendages.

This very unique nymph may be referred to *Tetracanthagyna* with assurance, and to the one known Philippine species, *T. bakeri,* with little doubt, because the developing wings of one male specimen show the following venational characters: ante- and postnodal crossveins 42:27 and 28:32 in fore and hind wings, respectively; no brace vein to the stigma; no crossveins in the midbasal space; six to eight cubito-anal crossveins, with some irregularity near the triangles; in the triangles two cells bordering the proximal side, followed by a row of four or five parallel crossveins; four rows of cells in the fork of Rs; the radial planate is nearly straight; it subtends four rows at widest separation from Rs, diminishing to two rows towards the wing margin; the median planate subtends four rows of cells; between the branches of Cu there is in the forewing a single row of cells, and in the hind wing, first two rows, then diminishing to one; the rather ill-defined anal loop of the hind wing seems to inclose four vertical rows of cells.

LUZON, Laguna Province, Los Baños, Molawin Creek, 2 female nymphs and 1 smaller male, April 1, 1927 (*Uichanco*).

LIBELLULIDÆ

Key to the subfamilies.

ADULTS

1. Triangle of hind wing much nearer arculus than in forewing; anal loop elongated, becoming foot-shaped, with a distinct midrib..... 2.
   Triangle of hind wing but little nearer arculus in forewing; anal loop hardly longer than wide and with no midrib..... MACROMIINÆ.
2. Anal loop scarcely foot-shaped, there being little development of the toe; hind wing of male strongly angulated and with an anal triangle (except in *Hemicordulia*)..... CORDULIINÆ.
   Anal loop generally foot-shaped, with well-developed toe: hind wing of male with anal angle rounded..... LIBELLULINÆ.

NYMPHS

1. Abdomen less than twice as long as wide; long-legged..... MACROMIINÆ.
   Abdomen more than twice as long as wide..... 2.
2. Hind femora distinctly longer than the head is wide; when lateral spines are long, there is a series of large cultriform dorsal hooks on the abdomen..... CORDULIINÆ.
   Hind femora about as long as the head is wide; when lateral spines are long the dorsal hooks are minute or wanting..... LIBELLULINÆ.

MACROMIINÆ

Key to the genera.

ADULTS

1. Triangle with crossveins..... *Epophthalmia.*
   Triangle without crossveins..... 2.
2. Triangle of hind wing distant from the arculus by more than its own length; veins M_3 and M_4 sagged and undulate..... *Macromia.*
   Triangle of the hind wing distant from the arculus by less than its own length; veins M_3 and M_4 smoothly curved..... *Macromidia.*

NYMPHS

1. Head with a transverse frontal shelf; lateral lobe of labium very deeply and irregularly cleft..... *Epophthalmia.*
   Head with a pyramidal frontal horn arising between bases of the antennæ; lateral lobe of labium rather regularly toothed along its distal margin..... *Macromia.*

EPOPHTHALMIA ELEGANS Brauer.

BRAUER, Verh. zool.-bot. Ges. Wien 15 (1865) 905, Malaysia; SÉLYS, An. Soc. Esp. Hist. Nat. 20 (1891) 211, Dolores.

This species has been recorded but once from the Philippines, and is not represented in the material before us. It is common in China and Japan. It is strong-flying and difficult to capture. It is readily recognizable by the characters given in our key;

by the presence of crossveins in the triangles, by having three or four cubito-anal crossveins in both wings, and by its size (hind wing 48 to 54 mm).

The nymph was described and figured by Cabot [10] and by the senior author [11] as *Azuma elegans*.

MACROMIA GERSTAECKERI Krüger. Plate 3, fig. 56.

KRÜGER, Stett. Ent. Zeit. 60 (1899) 335, Java; LAIDLOW, Journ. Str. Br. Roy. Asiat. Soc. 85 (1902) 225; MARTIN, Cat. Coll. Sélys 16 (1906) 70, Borneo, Malay Peninsula, Tonkin; LIEFTINCK, Tijd. v. Ent. 72 (1929) 106.

There is a single incomplete female specimen in the collections sent us. It lacks segments 4 to 10 of the abdomen. It agrees in rather close detail with the original description of *M. gerstaeckeri* in size (hind wing 37 mm) and in coloration, except that it is a little more extensively yellow (perhaps less mature). For example, there is a small spot of yellow just beneath each outer end of the antealar crest, the yellow crossband covering the anterior half of abdominal segment 2 is hardly divided by black on the middorsal line, although clearly divided on the middle of the sides of that segment, and the mesothoracic carina is wholly yellow. There is also a curving transverse line of long tawny hairs standing erect like a ruff a little distance behind the mesothoracic collar. This is not mentioned in the descriptions. Wings as in Plate 3, fig. 56.

One female pinned specimen, lacking the last six segments of the abdomen and bearing the label "13 VII 1915, C. S. Banks."

MACROMIA NEGRITO sp. nov. Plate 1, figs. 2, 3, and 15.

Length, 55 mm; abdomen, 41; hind wing, 38.

This is a rather slender blackish species with slightly fumose wings. Head black with a yellow band across the rear of the postclypeus, this band bordering an elevated hairy transverse ridge, and encircling that ridge at its dilated ends. Labrum black. Anteclypeus brown. Frons shining metallic greenish blue, without transverse carina, but deeply divided into two almost mammiform portions that are very hairy on the outer side. Vertex low, transverse grooved behind and hairy within the groove. Occiput black, clothed with long hairs in the rear. Rear of head black. Labium blackish, yellowish in its basal half.

Prothorax blackish above, paler across front and rear margins, the hinder one pilose. Synthorax metallic greenish black with

[10] Mem. Mus. Comp. Zool. 17 (1890) 9, pl. 1, fig. 1.
[11] Zool. Sinica (A) 11 fasc. 1 (1930) 109, pl. 11, figs. 5 and 5*a*.

lateral stripes of yellow, thickly clothed with long tawny hairs in front. Carina and crest black; antealar sinus yellow. Side stripes three; a short antehumeral one that runs upward from the middle of the mesinfraepisternum halfway to the crest; a midlateral one covering the spiracle running from the same level up to the alar crest; the rear stripe covers the postlateral ridge of the synthorax and is elongate triangular, pointed at the front end, widened rearward to the base of the abdomen. Underneath the rear of the synthorax a yellow Y mark divides the black into three distinct areas. Legs black beyond the pale coxæ, clothed with long thin spines. Claws cleft at tip with the lower division twice as heavy as the upper. Wings subhyaline, with black veins and stigma and flavescent membrane. Stigma hardly twice as long as wide. Membranule pale brown. Ante- and postnodal crossveins 14: 6 and 10: 6 in fore and hind wing, respectively.

Abdomen rather slender and elongate between the strongly swollen terminal segments, black with scanty yellow markings; five yellow spots on segment 2, one middorsal, and two lateral on each side, the anterior of these larger and situated in front of the black-edged auricle. Two obscure yellowish crossbars on segment 3 are interrupted on the middorsal line. Remainder of the abdomen black except for a small middorsal basal spot on segment 7 and small midlateral spots on 8 and 9. Segment 10 nearly smooth above, finely transversely rugose, produced a little in the rear and truncate above the base of the appendages. The appendages equal in length and about twice as long as segment 10 (Plate 1, figs. 2 and 3). Superiors stout and strongly carinate above in their basal half, at which level arises a very stout triangular lateral tooth, and beyond which they slightly converge to blunt tips. Form of tips obscured by a terminal cluster of unusually short stout bristles or fine spines. Under the more convex portion of their slightly upcurved tips a row of minute denticles. Inferior appendage is slightly carinate beneath at base, and its tip sharply recurved upward to a fine-pointed tip.

The female differs very slightly: The antehumeral yellow stripe reaches a little farther upward, the yellow markings of the abdomen are a little more extensive, and the swollen segments 8 and 9 of the abdomen tend to be a little more sharply keeled on the middorsal line and to end in a minute apical spine. Subgenital plate as shown in Plate 1, fig. 15.

LUZON, Laguna, Mount Maquiling, 1 male (type) and 1 female, June 9, 1932, in the same envelope and presumably taken together.

This species resembles *Macromia thalia* Fraser (described by Laidlaw as *M. frænata*) from Assam in the form of the male superior appendages as figured by Fraser.[12]

MACROMIA sp. ? Nymph. Plate 9, figs. 110 to 112.

Length, 22 mm; abdomen, 12; hind femur, 10; width of head, 6; width of abdomen, 8.

A flat, widely sprawling long-legged nymph with upturned horn on front of head. Coloration pale with blackish paired spots on thorax and on middle abdominal segments, and with blackish rings on femora. Head widest behind eyes, then narrowed to a slightly concave occipital border. A blackish crossband between the eyes broken by pale spots of the three ocelli. In front of it the predominantly yellow area about the low pyramidal horn bearing a black median stripe and paired triangular spots. Black rings on the two basal antennal segments, a row of spots on upper margin of the lateral labial lobes. Eyes produced upward in a low, conic, blunt-tipped, shining black prominence. Labium (Plate 9, figs. 110 to 112) wide, its hinge reaching the metathorax. Lateral setæ five; mentals seven on each side, in the innermost smaller. On the distal end of the lateral lobe six large obliquely rounded teeth, each of the middle ones armed at tip with about six spinules. Median lobe low, its undulant margin armed with a line of small spinules, produced in a prominent median tooth bearing a pair of spinules.

Prothorax wide and flat, its disc outlined in black. Outside its anterior angle a conspicuous triangular supracoxal process ending in a tuft of long yellowish hairs. Legs very long and thin. Feet spinulose-serrate beneath and ending in extremely long smooth tapering claws. Femora ringed with black near the bases and besprinkled with the same color more proximally. Wing cases reach backward well upon the sixth abdominal segment.

Abdomen broadly oval, strongly depressed, widest on segments 5 and 6. Dorsal hooks on 3 to 9, slender and erect on 3, laterally flattened on 4 to 9, highest on 4 and slowly declining to rearward. Segment 10 exserted, cylindric, two thirds as long as 9 middorsally. Appendages short and thick, about as long as 9 middorsally, subequal to each other.

[12] Tijd. v. Ent. 72 (1929) 104, fig. 21.

LUZON, Laguna Province, Los Baños, 3 nymphs, April 1, 1927 (*Uichanco*), Molawin Creek, 1 young specimen, June 18, 1930 (*S. M. Cendaña*); 6 badly preserved specimens, Laguna, lot A.

MACROMIDIA SAMAL sp. nov. Plate 1, fig. 18; Plate 3, figs. 52 and 57.

Length, 40 mm; abdomen, 38; hind wing, 31.

Female.—A rather broad-winged blackish species. Face all blackish, only the anteclypeus paler, very hairy with bluish reflections on the labrum and coppery on the frons. Frons low and divided by a shallow median grove. Vertex high, transverse, and bulging, with a dense covering of blackish hairs. Occiput narrow, bare, and brown.

Prothorax small and wholly pale, with only a pair of tufts of brownish hairs tipping the upper edge of its posterior lobe. Synthorax blackish with metallic greenish reflections from its more convex surfaces and with a covering of long tawny hairs in front. A narrow irregular numeral pale stripe deep in the suture, running down at an angle upon coxa and trochanter of the middle leg. Midlateral pale stripe much wider but not very sharply defined and not connected with the yellow of the hind coxa. An isolated broad streak covering part of third lateral suture, an area behind it, another area extending to the base of abdomen. Legs dark brown beyond their pale basal segments, with deeply forked claws of lighter brown (Plate 3, fig. 52). Wings (Plate 3, fig. 57) hyaline with blackish veins and a fuscous stigma, and with a brown spot covering base of both out to first crossveins. Brown less distinct in the forewing. The nodal crossveins 16:10 and 10:14 in fore and hind wing, respectively. Bridge crossveins five or six, four of them before level of subnodus. Two crossveins behind stigma, no distinct brace vein. Radial planate beginning at oblique vein coming down from the subnodus and extending directly to wing margin. Near its middle portion two of the included crossveins are oblique, marking the place where two accessory tracheal branches cross the planate. In the space beyond the triangle in the forewing a single row of cells for a distance of six crossveins, two rows for five more crossveins, and three rows to wing margin.

Abdomen slender, little enlarged even on basal segments, tending to be ridged middorsally, where traversed by a narrow pale median line on segments 2 to 9. A pale transverse area across base of 1, and a tuft of long tawny hairs on elevated hinder end of that segment. A pale spot on sides of 1 and 2 below and a narrow line of the same color extending along the inferior margins of all the segments to rearward to the base of 10, widening

a little on 7 and 8. Relative length of last four segments as 10 : 6 : 4 : 2, black appendages twice as long as segment 9. Subgenital plate (Plate 1, fig. 18) but slightly produced backward and divided full depth by a median notch. A pale midventral spot with a pair of rather large palps at its hind edge, the remainder of sternum of 9 smooth.

This very distinct species is most like *M. shanensis,* of India, in thoracic color pattern. It has a single row of crossveins beyond the forewing triangle—the character on which Fraser[13] mainly based a new genus, *Indomacromia,* that he later abandoned. Two species having this character are known from India.

MINDANAO, Zamboanga Province, Kabasalan, 1 female, July, 1932 (*H. C. Muzzall*).

CORDULIINÆ

Key to the genera.

ADULTS

1. Triangle in hind wing far beyond arculus ..... 2.
   Triangle in hind wing retracted to arculus ..... 3.
2. Triangle of forewing 4-sided ..... *Idiophya.*
   Triangle of forewing 3-sided ..... *Idionyx.*
3. Triangle divided into three cells; base of A_2 out from the anal crossing (*Ac*); radial planate subtends eight or more cells ..... *Heteronaias.*
   Triangle divided into two cells; A_2 opposite the anal crossing; radial planate subtends five cells ..... *Hemicordulia.*

NYMPHS

1. Synthorax wider than the head; teeth of lateral lobes of labium large. *Heteronaias.*
   Synthorax not wider than head; teeth of lateral lobes moderate ..... 2.
2. Teeth five; lateral spines minute, on eight vestigial ..... *Idionyx.*
   Teeth eight: lateral spines moderate; on eight distinct.. *Hemicordulia.*[14]

Genus IDIOPHYA Fraser

We are following Fraser in the use of this name for a new *Idionyx*-like species with a 4-sided triangle in the forewing, but with some doubt as to the validity of the genus.

ODIOPHYA SALVA sp. nov. Plate 3, fig. 58.

Length, 38 mm; abdomen, 32 (?) ; hind wing, 31.

A dainty little corduline with a 4-sided triangle in the forewing. Head with very large eyes meeting in a long seam, and

[13] Indian Mus. Rec. 26 (1924) 514.

[14] Characters taken from a nymph of *Hemicordulia assimilis* (supposition) Needham, Bishop Mus. Bull. 98 (1932) 113–114.

a very hairy face. Frons shining metallic green above where deeply grooved in the median line and minutely punctate on the bulging sides, front brown. Vertical vesicle dark metallic blue. Labrum and anteclypeus pale. Occiput a brown triangle, yellow at the sides.

Prothorax mostly pale. Synthorax metallic green on brown in front, and paler on the sides without full stripes but with yellowish streaks low down on the sides as follows: One on each of the two hinder coxæ, reaching down to the femora and up across the infraepisterna but not invading the episterna; one between these two and covering the spiracles; and a larger one in the form of a long triangle pointing downward covering a good part of the metepimeron. The short soft pile of the front of the thorax is golden brown. The legs are pale; femora thrice faintly ringed with brown. Leg spines very long, especially on the tibiæ, and numerous, claws bifid at the tip. Wings (Plate 3, fig. 58) hyaline, with only a faint tinge of yellowish at the base, along the costa, and within the veins of the stigma. Venation as shown in figure.

The abdomen (crushed and perhaps with the colors not fully developed) slender, a little dilated before the tip; yellowish brown in color, darker at the sides and across apical margin of the segments; cerci brown, hardly as long as segment 10. Subgenital plate as shown in fig. 16.

LUZON, Laguna Province, Los Baños, 1 female, April 25, 1931 (*F. Juan*).

In coloration of the thorax this species seems to resemble closely *Idionyx philippa* Ris, but it differs in venation from Ris's figure of the wings of that species [15] as follows: (*a*) In the space beyond the 4-sided triangle of the forewing a single row of cells continues beyond the level of the nodus, while in *I. philippa* beyond a 3-sided triangle the row is doubled well before the level of the nodus. (*b*) In our species veins Cu and Cu_2 of the same wing diverge to the wing margin while in *I. philippa* they converge.

IDIONYX PHILIPPA Ris.

RIS, Suppl. Ent. 1 (1912) 81–82, fig. of wing of female, Naujan, Mindoro.

Abdomen, 30 to 35 mm; hind wing, 30 to 35.

Female.—A handsome little corduline with a yellow-spotted metallic green thorax and a bright golden spot in each wing

[15] Suppl. Ent. 1 (1912) 81, fig. 16.

base reaching out to the triangle. Labrum yellow with a broad black front border. Frons and vertex shining metallic green, the former with a deep, median, longitudinal furrow, the latter broadly rounded.

Prothorax yellow, including the front lobe of the dorsum, behind which the dorsum is black. Synthorax shining metallic green, clothed in front with long tawny hairs, and with a row of four yellow spots low on the sides, the first above the middle coxa, the second on the spiracle, the other two on the metepimeron. Coxæ yellow behind; femora and tarsi black, tibiæ a little paler. Wings beyond the golden basal spot (which may cover the triangles) subhyaline, more deeply tinged towards the stigma. Ante- and postnodals 13 : 6–7 and 9 : 9 in fore and hind wings, respectively. Stigma fuscous, slightly narrowed and pointed apically, covering two cells. In the anal loop four or five cells in the distal and six or seven in the proximal rows.

Abdomen black with a marginal yellow streak on the ventral margins of segments 2 and 3. Subgenital plate a little produced backward, its end upturned and raised in a low longitudinal carina. Sternum of 9 also a little produced. Appendages conic, about as long as the middorsal length of 10; these and the subanal plates tufted with brownish hairs.

LUZON, Laguna Province, Los Baños, 3 females, no date.

One venational character given by Ris in his key to the species,[16] "but one cell bordering the distal side of the triangle," does not hold for any of our specimens. The position of the first crossvein in the space beyond the triangle of the hind wing is variable, its upper end descends along the triangle for a little way in our specimens.

IDIONYX sp. ? Nymph. Plate 8, figs. 93 to 95.

Length, 19 to 20 mm; abdomen, 12; hind femur, 5; width of head, 5; width of abdomen, 6.5.

A smooth, slender-legged nymph with blunt-tipped abdomen. Head compact, with eyes at middle of sides and contracted at their rear margin, between which and the low hind angles is a slightly bulging scurfy pubescent area. Occipital margin straight. Frons a little prominent between the bases of the antennæ with the mouth parts projecting and the large teeth of the labium showing plainly from above. Antennæ 7-jointed, slender, pale, and hairless. Labium (Plate 8, figs. 94 and 95) rather short, its hinge reaching the mesothorax. Lateral lobes

[16] Op. cit. 80.

subtriangular, with five lateral setæ and a long straightish movable hook, and about six coarse teeth on the terminal border. The three large middle teeth wider than high, obliquely rounded, each armed with about a dozen spinules in double array longer and shorter. Median lobe low triangular, evenly contoured, spinulose margined, and bearing on each side eleven raptorial setæ.

Prothorax rather small, its disc with obtuse laterally projecting angles inclined slightly to rearward, far behind the blunt, vertically inclined, hairy supracoxal process. Legs concolorous, slender, with tibiæ thinly hairy. Hind femora reaching middle of abdominal segment 6. Wings streaked and shaded with brown.

Abdomen strongly depressed, oblong, of about equal width on segments 6 to 8, narrowed mostly on 9, with strong lateral spines on 8 and 9, and with a fringe of long hairs across the apex of 9 beneath. No dorsal hooks. Appendages short, sharply pointed, superior an equilateral triangle, its tip on a level with that of the spines of 9; laterals slenderer, slightly shorter and with outcurving tips.

LUZON, Laguna Province, Mount Maquiling, Molawin Creek, altitude 200 feet, 3 nymphs; and 2 nymphs labeled "Laguna, P. I."

Venation well preserved in the nymphal wings and generic determination positive.

Genus HETERONAIAS novum

Genotype, *Epitheca heterodoxa* Sélys.

In describing the male of this peculiar species in 1878, de Sélys first placed it in *Epitheca,* remarking that it differs from the other species of that genus in having the triangle of the forewings divided into three cells, and in having the stigma notably short. But in his summary list at the end of this same paper the name appears as a species of *Somatochlora.*

Martin in 1906 stated that the male and female types are in the de Sélys collection, but he makes no mention of the very peculiar characters of the female nor does he describe it. He does say,[17] however, "Espece remarquable por ses fémurs roux très gros, longs de 8 mm."

E. M. Walker (1925), discussing the affinities of the genus *Somatochlora* in his monograph of the North American species of that genus, thus refers to *H. heterodoxa:*

[17] Coll. Zool. Sélys 17 (1906) 21.

> I have not seen this species, but it shows * * * with Procordulia an instability in the development of the second cubito-anal crossvein of the hind wings, which feature together with its geographical range throw considerable doubt on the probability of its being a genuine Somatochlora.

F. F. Laidlaw in 1928 referred this species to *Procordulia,* saying that it could be so referred without much difficulty, and that it is not a true *Somatochlora.* He adds, however:

> It is possible that *heterodoxa* may ultimately require the creation of a distinct genus to hold it. This genus would be characterized by the absence of an internal triangle in the hind wings, the presence of an accessory bridge-nerve, and the brilliant metallic coloring of the body, with the thorax unmarked. The upper anal appendages of the male long, straight, and bluntly pointed, and the second tibia without keel.[18]

Thus it will be seen that a number of the peculiarities of this species have been noticed hitherto: Long femora, very short stigma, 3-celled triangle in the forewing, absence of a second cubito-anal crossvein in the hind wing, presence of extra bridge crossveins, and the form of the abdominal appendages in the male. Singularly enough the form of the abdomen in the female has not been noticed. But it is the extraordinary nymph that sets it farthest apart from all known genera of Corduliinæ.

The genus may now be further characterized as follows: Head with a rather large occiput that is about as long as the eye seam in front of it. Frons deeply bilobed by a wide longitudinal furrow, in front rounded and having no transverse carina or angulation. Legs long, tibiæ armed with numerous long spines, femora with a single subterminal spine and before it a long series of very minute denticulations. Claws bifid, with the lower division slightly shorter than the upper. Front wing triangle and subtriangle both 3-celled, followed by two rows of cells. In both wings there is a very long space without crossveins on each side of the subnodus. The narrow stigma is diamond-shaped, its sides hardly twice as long as its ends, and behind it stands a single crossvein. There are three bridge crossveins and a sagging radial planate subtends about ten rather large cells. In the hind wing vein A_2 arises beyond the anal crossing (*Ac*), and the base of the two-celled triangle is retracted to slightly before the arculus. The anal loop is elongate, sagging, almost foot-shaped, with slight development of a toe; a well-developed midrib, arising near vein A_2, divides the two rows very unequally, the cells on the distal sides being much larger.

[18] Proc. Zoöl. Soc. London (1928) 133.

The anal triangle in the male is generally 2-celled with the dividing crossvein near its pointed rear end. The abdomen is moderately swollen on the three basal segments, narrow and depressed on the middle segments, then slowly enlarged to segment 9. Appendages of the male about as long as 9 and 10 together. In the female the enlarged end segments are compressed, the subgenital plate is divided in a pair of triangular flaps with a U-shaped notch between. The sternum of segment 9 is prolonged beyond the apex of 10, inclined downward to a blunt extremity and keeled. The appendages of the female are elongate-conic and much longer than segment 10.

HETERONAIAS HETERODOXA Sélys. Text fig. 2.

SÉLYS, Bull. Acad. Belg. II 45 (1878) 192, male, Luzon (in list on p. 217 placed in *Somatochlora*); An. Soc. Esp. Hist. Nat. 11 (1882) 16; MARTIN, Coll. Zool. Sélys 17 (1906) 20; WALKER, Univ. of Toronto Biol. Stud. 26 (1925) 16; LAIDLAW, Proc. Zoöl. Soc. London for 1928 (1928) 132 (referred to *Procordulia*).

Male, length, 63 mm; abdomen, including appendages, 46; appendages, 7; hind wing, 40 to 44.

Female, length, 59 mm; abdomen, 44; hind wing, 42 to 44.

This is a brownish clear-winged species with shining metallic green on the convexities of the frons and the thorax, and on the dorsum of the abdomen of the fully developed male. It will be easily recognized by the generic characters stated above and by the figures.

LUZON, Laguna Province, Los Baños, 7 males and 3 females, no date, 1 male, February 23, 1930 (*Pangramuyen*), 1 male, February 7, 1932 (*M. Macasaet*); Mount Maquiling, 2 males and 1 female, no date; Mount Banahao, 2 males, May 22, 1933 (*A. Y. Coronel*): Tayabas Province, Quezon Park, 1 female, May, 1931 (*F. Juan*).

HETERONAIAS sp. Nymph (determined by venation).

Length, 24 mm; abdomen, 13; hind femur, 10; width of head, 7.5; width of abdomen, 8.

A sprawling, long-legged, flat-bodied nymph, with a bulky synthorax wider than either head or abdomen. Head wider than long, with rather small, well-rounded, laterally prominent eyes behind which it is narrowed to the occiput. A suborbital longitudinal carina appearing from above as a projecting angle just behind the eye. Top of head sloping forward to the mouth, the huge teeth of the labium showing plainly from above. Antennæ 7-jointed. Labium short and wide, its hinge not reaching

back to the mesothorax. Lateral lobe more or less hand-shaped, the teeth on the end long, almost like fingers, the edges incurved. Lateral setæ eight; mentals nine or ten, the two series set in a straight line across the mentum parallel to its front border. Teeth seven, each bearing long spines at the tip, the spines numbering 0, 1, 2, 3, 3, 3, respectively, and a toothlike ending of the inner margin bearing a dense cluster of more than a dozen

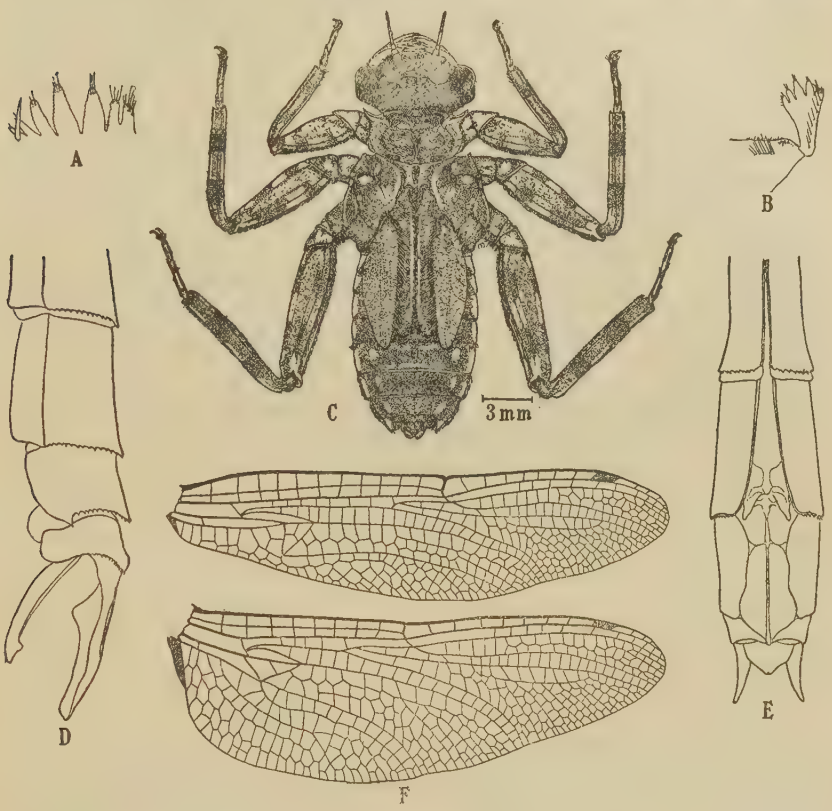

FIG. 2. *Heteronaias heterodoxa* Sélys; A, Tip of lateral lobe of labium of nymph; B, labium of nymph; C, nymph; D, lateral view of tip of abdomen of male; E, ventral view of tip of abdomen of female; F, wings.

spines. The edges of the tenth bear close set, microscopic crenulations. The moveable hook is straight, about as long as the lateral setæ, and regularly tapering. The median lobe is truncate, scarcely at all produced, and bordered with about a dozen major crenulations with spines set between them, and each of these is margined with minor crenulations with a row of spinules at their proximal edges.

Thus this "mask" is not floored by a median lobe, but by the lower inrolled edges of the two scooplike lateral lobes.

Prothorax with a rather small obscurely margined disc, beyond the anterolateral angle of which a long spinelike supracoxal process projects forward, parallel to the sloping hind angle of the head. In corresponding position on the wide metathorax there is an angulate process projecting forward towards the front coxa. Spiracles conspicuous. Sides of synthorax depressed. Legs long and strong, doubly carinate above and below, femora flat on the sides. Hind femora reach the middle of abdominal segment 8. Wing cases reach 7.

Abdomen oval in outline, rather short, flat, and wide, with blunt lateral spines on segments 8 and 9, those of 8 short, those of 9 long, reaching almost to the level of the tips of the appendages. Dorsal hooks represented by long blunt tubercles on segments 8 to 10, highest on 9. Appendages short and wide; inferiors longest, externally rounded to the blunt apex, superiors a little shorter, triangular, sharp-pointed, laterals still shorter, blunt-tipped.

Coloration mottled with a darker middorsal line and paler markings in the "scars" near the margin from the edges of which arise tufts of long whitish hairs.

A number of specimens, one only fully grown, from Molawin Creek, Mount Maquiling, Laguna, Luzon, at 200 feet altitude. This one had the wings crumpled within their sheaths, but when expanded they showed the adult venation, rendering the determination positive.

HEMICORDULIA MINDANA sp. nov. Plate 1, figs. 19 and 20.

Length, 57 mm; abdomen, 43; hind wing, 31.

A handsome metallic green species, paler on the sides and beneath, and becoming blackish towards the end of the abdomen; face amber brown, including the whole of the labrum; sparsely hairy on the frons; top of frons and vertex brilliant metallic green, both sparsely hairy; antennæ black; occiput brown, beset in the middle in front with long tawny hairs behind which it is bare. In the female the occiput is produced backward, declined, and bilobed, with a brush of short stiff bristles arming each lobe externally (Plate 1, fig. 19).

Thorax brown with a pair of very broad, shining, metallic green bands that almost cover its front. On the sides similar diffuse metallic bands overspreading the deep lateral sutures (obsolete above the spiracle on the middle suture), conjoining

with them below, and extending rearward on the lower part of the metepimeron. Four streaks of paler yellowish brown occupying the middle portion of the pleural sclerites between the metallic stripes, the foremost one running down on the middle coxa, the others circumscribed below by darker color. Wings subhyaline, tinged with brownish around the crossveins, especially in the females; veins and stigma brown. The thin, sharp-edged basal dilation of the costa on the forewing yellowish. Ante- and postnodal crossveins in the forewing 7:5, in the hind wing 5:7, respectively; veins M_3 and M_4 twice convergent towards the end, once at the bend, and again at the hind margin with a single cell row between them all the way; median planate well developed. Legs black; first femora paler externally.

Abdomen metallic green above except for a pale basal segment, with diffuse brown areas on the side of segments 2 and 3; 1 and 2 clothed above with tawny hairs; superior appendages longer than segments 9 and 10 together; the inferior one-sixth shorter than the superiors. Hamules as shown in Plate 1, fig. 20.

MINDANAO, Kabasalan, 1 female (type), July, 1932 (*H. C. Muzzall*): Cotabato Province, Kidapauan, a damaged male (allotype), United States National Museum (*B. P. Clark*).

LIBELLULINÆ

Key to the genera.

ADULTS

1. Anal loop present ..... 2.
   Anal loop absent ..... *Orchithemis.*
2. Anal loop foot-shaped ..... 5.
   Anal loop not foot-shaped ..... 3.
3. Hind wing 25 mm or less ..... 4.
   Hind wing 30 mm or more ..... *Agrionoptera.*
4. Anal loop open ..... [*Nannophya*].
   Anal loop closed ..... *Tetrathemis.*
5. Midrib of anal loop much nearer A_2 ..... 7.
   Midrib of anal loop halfway between A_1 and A_2 ..... 6.
6. Last antenodal crossvein continuous ..... [*Nannodiplax*].
   Last antenodal crossvein discontinuous ..... *Diplacodes.*
7. Forewing triangle crossed ..... 14.
   Forewing triangle not crossed ..... 8.
8. Anal loop with toe closed ..... 9.
   Anal loop with toe open ..... *Raphismia.*
9. Last antenodal crossvein continuous ..... 10.
   Last antenodal crossvein discontinuous ..... *Zygonyx.*
10. Cu_1 arising from hind angle of triangle ..... 12.
    Cu_1 arising from distal side of triangle ..... 11.

11. Hind wing less than 23 mm; cells in hind angle greatly elongated. *Acisoma.*
    Hind wing more than 23 mm; cells in hind angle not greatly elongated. *Diplacina.*
12. A_2 opposite the anal crossing (*Ac*) ..... 13.
    A_2 beyond the anal crossing ..... *Brachydiplax.*
13. Five postnodal crossveins ..... *Macrodiplax.*
    Seven postnodal crossveins ..... *Urothemis.*
14. Toe of anal loop closed ..... 16.
    Toe of anal loop open ..... 15.
15. One row of cells above the radial planate ..... *Zyxomma.*
    Two rows of cells above the radial planate ..... *Tholymis.*
16. Less than five rows of cells in discoidal field ..... 19.
    Five or more rows of cells in discoidal field ..... 17.
17. Forewing triangle reticulately crossed; a large number of antenodal crossveins ..... 18.
    Forewing triangle simply crossed ..... *Rhyothemis.*
18. M_2 smoothly curved ..... *Neurothemis.*
    M_2 undulate ..... *Camacinia.*
19. Less than four rows in the discoidal field ..... 21.
    Four rows in the discoidal field ..... 20.
20. Base of hind wing greatly widened ..... *Tramea.*
    Base of hind wing normal ..... *Neurothemis.*
21. Three rows of cells in the discoidal field ..... 22.
    Two rows in the discoidal field ..... *Diplacina.*
22. M_2 smoothly curved ..... 27.
    M_2 undulant ..... 23.
23. Anal loop normal foot-shaped ..... 24.
    Anal loop with a very long heel ..... *Hydrobasileus.*
24. One cubito-anal crossvein ..... 25.
    Two cubito-anal crossveins; stigma shorter in hind wing ..... *Pantala.*
25. Last antenodal crossvein discontinuous; A_2 out from anal crossvein. 26.
    Last antenodal crossvein continuous; A_2 opposite anal crossvein. *Orthetrum.*
26. Hind wing less than 35 mm ..... *Potamarcha.*
    Hind wing more than 37 mm ..... *Onychothemis.*
27. More than nine and one-half antenodal crossveins ..... 29.
    Less than nine and one-half antenodal crossveins ..... 28.
28. Abdomen much constricted after third segment ..... *Trithemis.*
    Abdomen not so constricted ..... *Brachythemis.*
29. Last antenodal crossvein discontinuous ..... 31.
    Last antenodal crossvein continuous ..... 30.
30. Extra bridge crossveins: one cubito-anal ..... *Cratilla.*
    No extra bridge crossveins: three cubito-anals ..... *Lyriothemis.*
31. A_2 smooth: two crossveins under stigma ..... 32.
    A_2 zigzag: four crossveins under stigma ..... *Lathrecista.*
32. Usually one row of cells above radial planate; stigma long; discoidal field widening at edge of wing ..... *Crocothemis.*
    Two rows of cells above radial planate; stigma short; discoidal field narrowing at edge of wing ..... *Trithemis.*

For convenience the genera are discussed, not in any phylogenetic orders, but in the order of their names in the key. The phylogeny of the group has not been well worked out. To that end nothing would contribute more than further knowledge of the immature stages. Nymphs are still unknown for a majority of the Philippine genera. Two regional genera not yet recorded from the Islands are indicated in the key by square brackets.

Verification table.

Genus.	Forewing.						
	Cross-veins in triangle.	Cells in subtriangle.	Last antenodal cross-vein.	Extra bridge cross-veins.	Cell rows subtended by the radial planate.	Cell rows within the discoidal field.	M_3.
Acisoma	0	1	C [a]	0	1	2	s [b]
Agrionoptera	1	3	C	0	1–2	2	s
Brachydiplax	0	2–3	C	0	1	2	s
Brachythemis	1	3	D	0	1–2	3	s
Camacinia	10	20	v	3–4	3	5	u
Cratilla	1	3	C	1–3	2	3	s
Crocothemis	1	3	D	0	1–2	3	s
Diplacina	0–1	1–3	C	0	1	2	s
Diplacodes	v–1	1–3	D	0	1	2	s
Hydrobasileus	2	6–8	D	0	2	3	u
Lathrecista	1	3	D	0	1–3	3	s
Lyriothemis	1	3	C	0	1	3–2–3	s
Macrodiplax	0	3	C	0	1	2	s
Nannophya	0	1	C	0	1	2	s
Neurothemis	1–9	1–14	v–D	v	1–2	4–7	s
Onychothemis	1	3	D	0	2	3	u
Orchithemis	0	1–2	C	0	1	2	s
Orthetrum	1	3	C	0	1–2	3	u
Pantala	1	3–5	D	0	2	3	u
Potamarcha	1	3	v–D	0	2	3	u
Raphismia	0	1–3	D	0	1	2	s
Rhyothemis	2–3	7–10	D	0	2	5	s
Tetrathemis	0	1	C	0	1	1	s
Tholymis	1	3–4	D	0	2	3	s
Tramea	1–2	3–7	D	0	2	4	s
Trithemis	1	3	D	0	1–2	3	s
Urothemis	0	3	C	0	1	2	s
Zygonyx	1	1–2	D	0	1	2	s
Zyxomma	1	3	D	0	1	3	s

[a] C, continuous; D, discontinuous. [b] s, smoothly curved; u, undulate.

Verification table—Continued.

Genus.	Hind wing.						
	Cross-veins in triangle.	Vein Cu 1.	Vein A 1.	Cubito-anal cross-veins.	Base of triangle.	Anal loop.	Length.
							mm
Acisoma	0	U [a]	out [b]	1	a [c]	f c [d]	17–22
Agrionoptera	0	D	out	1–2	d	n c	30–39
Brachydiplax	0	D	out	1	a	f c	21–32
Brachythemis	0	D	v	1	a	f c	23–29
Camacinia	2–3	D	opp	2	a	f c	47–48
Cratilla	1	D	opp	1	a	f c	34–39
Crocothemis	0	v–D	v–opp	1	a	f c	27–35
Diplacina	v	U	v	1–2	a	f c	34–36
Diplacodes	0	U	v	1	a	f c	19–22
Hydrobasileus	0	D	opp	1	a	f c	40–48
Lathrecista	0	D	out	1	a	f c	31–35
Lyriothemis	1	D	out	3	a	f c	24–37
Macrodiplax	0	D	opp	1	p	f c	30–35
Nannophya	0	U	out	1	a	n o	13–15
Neurothemis	1–3	D	v	1–2	a	f c	19–31
Onychothemis	0	D	opp	1	p	f c	37–46
Orchithemis	1	v	out	2	d	n o	23–24
Orthetrum	v	v	opp	1	a	f c	26–44
Pantala	0	D	v	2	a	f c	39–41
Potamarcha	1	D	out	1	a	f c	31–34
Raphismia	0	v	out	1	d	f o	25–27
Rhyothemis	0	D	opp	1	a	f c	30–40
Tetrathemis	0	U	out	3	d	n c	17–24
Tholymis	0	D	opp	1	a	f o	31–37
Tramea	0	D	opp	1	a	f c	45–50
Trithemis	0	D	opp	1	a	f c	23–34
Urothemis	0	U	opp	1	a	f c	37–40
Zygonyx	0	U	opp	1	p	f c	40–45
Zyxomma	0	v–U	opp	1	a	f o	33–40

[a] U, Arising from the outer side of the triangle; D, arising from the hindmost angle of the triangle.

[b] out, Arising beyond anal crossing; opp, arising opposite anal crossing.

[c] a, At arculus; p, proximad; d, distad.

[d] f, Foot-shaped; n, not foot-shaped; c, complete; o, open at toe.

Key to the genera.

NYMPHS

1. With middorsal hooks on some abdominal segments ..... 2.
   With no middorsal hooks on any abdominal segment ..... 8.
2. With a middorsal hook on segment 9 ..... 3.
   With no middorsal hook on segment 9 ..... 6.
3. Teeth on lateral lobe of labium large ..... 4.
   Teeth on lateral lobe of labium obsolete ..... 5.
4. Small (length 12 mm); abdomen flattened, its appendages short. *Tetrathemis.*
   Large (length 23 mm); abdomen sharply triquetral, its appendages long ..... *Tholymis.*

5. Lateral setæ of labium 6 ..... *Brachythemis.*
   Lateral setæ of labium 9 ..... *Lyriothemis.*[19]
6. Eyes produced laterally in a recurved cone, sharply pointed. *Hydrobasileus.*
   Eyes normal ..... 7.
7. Dorsal hooks laterally flattened; a minute lateral spine on segment 7. *Brachydiplax.*
   Dorsal hooks more spinelike; no minute lateral spine on segment 7. *Orthetrum.*
8. Lateral spines obsolete ..... *Acisoma.*
   Lateral spines well developed ..... 9.
9. Lateral spines on segments 7 to 9 ..... *Diplacina.*
   Lateral spines on segments 8 and 9 only ..... 10.
10. Lateral setæ of labium 4 or 5 ..... *Diplacina.*
    Lateral setæ of labium 9 or more ..... 11.
11. Lateral spines short, not longer than the segments that bear them. 12.
    Lateral spines about twice as long as the segments that bear them. 14.
12. Lateral setæ 11 ..... 13.
    Lateral setæ 9 ..... *Neurothemis.*
13. Small (length 15 mm), mental setæ 12 to 13 ..... *Diplacodes.*
    Larger (length 22 mm), mental setæ 15 ..... *Crocothemis.*
14. Superior abdominal appendage longer than the inferiors ..... *Pantala.*
    Superior abdominal appendage shorter than the inferiors ..... *Tramea.*

Verification table.

Genus.	Abdomen.				Labium.		
	Length.	Segments bearing lateral spines.	Segments bearing dorsal hooks.	Length of inferior appendages in relation to abdominal segments.	Lateral setæ.	Mental setæ.	Teeth on lateral lobe.
	mm.						
Acisoma	14	(a)	(a)	=9	7	14	Obsolete.
Brachydiplax	20	8–9	4–8	=9+10+	11	15	Do.
Brachythemis	20	8–9	4–9	=9	6	10–12	Do.
Crocothemis	22	8–9	(a)	=9+10	11	15	Do.
Diplacina	18	7 or 8–9	(a)	=9+10	4– 5	4– 5	Low.
Diplacodes	15	8–9	(a)	=9+10	10–11	12–13	Obsolete.
Hydrobasileus	25	8–9	4–8	=9+10	9	11	Do.
Lyriothemis	17	8–9	4–9	=9	9	12	Do.
Neurothemis	15	8–9	(a)	=9	9	12	Do.
Orthetrum	17	8–9	4–8	=9	5– 8	3+	Medium.
Pantala	25	8–9	(a)	=9+10+	12–14	15	Large.
Tetrathemis	12	8–9	4–9	=9+10	9	12–13	Do.
Tholymis	23	8–9	4–10	=9+	8	11	Do.
Tramea	27	8–9	(a)	=9+10+	11	12	Low.

[a] Obsolete.

[19] These characters are taken from *L. pachygastra*, reared by the senior author in China [Zoöl. Sinica (A) 11 fasc. 1 (1930) 156, pl. 14, fig. 4] and that species differs so markedly from the Philippine *L. cleis* (type of the genus) that its nymph may hardly be expected to conform.

ORCHITHEMIS PULCHERRIMA Brauer. Plate 4, fig. 61.

BRAUER, Sitz. Akad. Wien 77 (1878) 6, male, female, Malacca, Johore, Pengullon Patie; RIS, Cat. Coll. Sélys 9 (1909) 85, figs. 54, 55.

This species appears not to have been reported hitherto from the Philippines, and it is represented in the material sent us by only a single male, which is labeled "Los Baños(?)." It is Ris's "black form" of this species—black above on the whole body, metallic on the frons above the yellow face. It is further characterized by very slender legs and narrow wings. The most unique character in its venation is the absence of an anal loop in the hind wing (Plate 4, fig. 61).

Length of hind wing, 25 mm.

Genus AGRIONOPTERA Brauer

We are able to report two species of this rather primitive genus, one of which has long been known and the other of which is new. Both are characterized in venation by a short anal loop, with a distinct midrib, but not foot-shaped, lacking the toe entirely; by having the triangle of the hind wing situated well beyond the arculus; by having the arculus in both wings situated beyond the second antenodal crossvein; and by having fairly well-developed planates, both radial and median.

There are differences in venation that may be used to distinguish the two species, as follows:

1. With only a single bridge crossvein; radial planate subtends a single row of cells; the anal loop is widened at the base and rounded at the apex; and in the hind wing the triangle is distant from the arculus nearly its own length ..... *quatuornotata.*

With two or three bridge crossveins; the radial planate subtends two rows of cells in its middle portion; the anal loop is parallel-sided to the base and obliquely truncate at the apex; and in the hind wing the triangle is retracted almost to the arculus..... *bartola* sp. nov.

AGRIONOPTERA QUATUORNOTATA Brauer. Plate 4, fig. 60.

BRAUER, zool.-bot. Wien 17 (1867) 289, 298, male, Menado; SÉLYS, Mitt. Mus. Dresden (1878) 294; An. Soc. Esp. Hist. Nat. 11 (1882) 10 (as *insignis*); KIRBY, Trans. Zoöl. Soc. London 12 (1889) 292, pl. 56, fig. 3; RIS, Cat. Coll. Sélys 10 (1909) 138, fig. 98.

Celebes, Philippines, Yap, Saleyer, Djampea, Kalao, Ponape.

SAMAR, Oquendo, 1 female, December 30, 1931 (*F. Reformina*). MINDANAO, Zamboanga, Kabasalan, 1 female, July, 1932 (*Muzzall*).

The Samar specimen shows the beautiful color pattern described by Ris,[20] while the Zamboanga specimen is obfuscated with black. In both the hind wing measures 33 mm.

[20] Cat. Coll. Sélys 10 (1909) 138–139.

AGRIONOPTERA BARTOLA sp. nov. Plate 1, fig. 17; Plate 4, fig. 59.

Female, length, 45 mm; abdomen, 28; hind wing, 41.

A long-winged species with bright yellow face below a shining metallic blue frons. Labium yellow with a black median stripe that widens basally to cover the median lobe. Labrum yellow with a narrow black front margin. Mandibles black with a large external yellow spot. Frons all shining blue except a large roundish yellow spot next the eye and confluent below with the yellow of the clypeus. Vertex metallic blue, sunken in the middle and rimmed around the edge next the ocelli. Occiput brown, shining above, on its rear face a twin spot of bright yellow, covered with pale tawny hair. Another large yellow spot on the posterior face of the ridge behind each eye.

Prothorax black above, with two cross stripes of yellow, the narrower one at the front, marginal, and with a large yellow median twin spot on the hinder part. Synthorax black with greenish reflections, striped with yellow and pruinose beneath between legs and abdomen. A middorsal yellow stripe covering carina and followed by a twin spot in the antealar sinus, then a large spot, a triple spot, and another large spot between the wing bases. An irregular humeral stripe, angulated at the lower end of the humeral suture, extending down to the middle coxa, and upward halfway to the wing above it; widely separated from it two small isolated spots, one on either side of the upper end of the humeral suture. Two irregular narrow stripes following the other two lateral sutures, the rear one incomplete below. Legs black with pale basal segments and with inner face of the front femora yellow. Wings (Plate 4, fig. 59) subhyaline with a long heavy very dark brown stigma. Ante- and postnodal crossveins of the type specimen 15 : 13 and 13 : 13 in fore and hind wing, respectively. The triangle retracted almost to the arculus, its inner end almost in line therewith. Anal loop short, its two rows of inclined cells, from five to nine in number, having one more cell in the hind than in the front row. Anal loop not boot-shaped, but looking as if the foot were cut off at the angle, its terminal bordering vein, A_1, perpendicular to the long axis of the wing. Two bridge crossveins.

Abdomen black with segments 6 and 7 conspicuously red within black marginal carinæ. Venter similarly but less conspicuously colored. On segment 1 three roundish spots of yellow, one midlateral on each side, and one middorsal. Behind the latter a narrow interrupted median line of yellow on segments 2 to 5, near the lateral margins a similar but more widely interrupted

line of yellow on 3 to 5. Segment 8 deep black including lateral expansions. Terminal segments only a little paler beneath where clothed with short tawny hairs. Subgenital plate as shown in Plate 1, fig. 17.

This species is nearly allied to *A. sexlineata* Brauer, but is distinctly larger, has a yellow, not an olivaceous face, the humeral yellow stripe abbreviated, not entire, and the fifth abdominal segment wholly black.

Nannophya pygmæa Rambur, ranging from China to Celebes and beyond, should be found in the Philippines. It is the smallest of known libellulines (hind wing 13 to 14 mm) and will be readily recognized by its 4-sided triangle, its anal loop open to rearward, a wide space without crossveins behind the stigma, and the small number of antenodal crossveins, five in the forewing and four in the hind (Plate 4, fig. 63). The nymph is unknown.

Genus TETRATHEMIS Brauer

This unique genus is markedly primitive in certain features of its venation. For example, the triangle of the forewing is 4-sided, that of the hind wing but little retracted towards the arculus, the cubital vein very moderately deflected at the triangles; it shows several cubito-anal crossveins, a weak development of the anal loop, and no planates are developed. We present a description and a figure of its nymph, which also shows primitive characters—characters that appear in the mature nymphs of the more generalized cordulines, and in the early instars of many libelluline nymphs, such as the pair of tubercles on top of the head and the middorsal row of cultriform hooks on the abdominal segments.

TETRATHEMIS IRREGULARIS Brauer. Plate 4, fig. 64.

BRAUER, Verh. zool.-bot. Wien 18 (1868) 183, 727, female, Mindanao; SÉLYS, Ann. Mus. Dresden (1878) 295; An. Soc. Esp. Hist. Nat. 11 (1882) 9; RIS, Cat. Coll. Sélys 9 (1909) 47, Luzon.

This, the only species known to occur in the Philippines, will be readily recognized by the generic characters stated above and by those of our key, table, and wing figures (Plate 4, fig. 64). Judging by the collections before us it is not uncommon in Luzon. Our adult material is as follows:

LUZON, Rizal Province, Makabud, March 19, 1930, June 16, 19, 20, 22, 30 (*A. C. Duyag*); Novaliches, July, August, 1930 (*Duyag*); Pasig, June 4 (*Duyag*); San Francisco del Monte, June 5 (*Duyag*): Tayabas Province, Lucban, June 20, 1930

(*McGregor and Rivera*), January 27, 1931 (*F. Rivera*). MINDANAO, Kabasalan, Zamboanga, July, 1932 (*H. C. Muzzall*).

We have a few nymphs from Zamboanga, and these are well enough preserved to show clearly the venation in their wings. The latter is so very distinctive that there can be no doubt about the generic determination, even though the nymphs have not been reared.

TETRATHEMIS IRREGULARIS. Nymph. Plate 9, fig. 100.

Length 12 mm; abdomen, 7; hind femur, 4; width of head, 4; width of abdomen, 5.

A small, slender-legged nymph with a broadly depressed abdomen. Head widest across the prominent eyes, narrowed behind them to a nearly straight occipital border, smoothly rounded above with a transverse row of brownish longitudinal streaks in the rear. Antennæ ringed and "mask" spotted with brown. Labium (Plate 9, figs. 98 and 99) rather slender basally, its hinge reaching the middle of the mesothorax; mentum with a Y-shaped widening to bases of the lateral lobes. Lateral setæ nine, very slender, especially the proximal ones, the end hook long and thin, with increasing curvature towards the tip. On the distal margin the six or seven teeth are about as high as wide, obtuse, slightly oblique, each armed with two or three spinules. Mental setæ twelve or thirteen, in a regular graduated series, with the fourth or fifth, counting from the side, longest.

Prothorax rather short and wide, its disc projecting forward in a prominent obtuse angle, below it a low hair-tufted supracoxal process. Legs sparsely hairy, pale, femora twice ringed with brown. The wing cases reaching backward to abdominal segment 6.

Abdomen widest on segment 7, thereafter abruptly tapering to a subtruncate tip. Lateral spines on 8 and 9 subequal, those on 9 pointing sharply inwards. Dorsal hooks on 4 to 9, on 4 small, on 5 to 9 subequal, low, stout, strongly directed to rearward. Segments 7 to 9 slightly decreasing in length, 10 annular, almost included in the apex of 9. Appendages short and thick, hardly surpassing level of tip of lateral spines on 9, superior and inferiors subequal, triangular, cuspidate-pointed; the laterals cylindric, slightly shorter.

MINDANAO, Zamboanga, 5 nymphs.

Genus DIPLACODES Kirby

Here belong two small species, one of which, *D. trivialis*, is among the commonest in the Islands. They can readily be recog-

nized by the following combination of venational characters: a half antenodal crossvein in the forewing, a long space without crossveins before the stigma in both wings, vein Cu_2 arising from outer side of the triangle in the hind wing.

Our two species may easily be distinguished as follows:

1. Forewing triangle free from crossvein; subtriangle of one or two cells. *nebulosa.*
   Forewing triangle crossed; subtriangle of three cells ..... *trivialis.*

DIPLACODES NEBULOSA Fabricius.

FABRICIUS, Entom. Syst. 2 (1793) 379, male, Oriental India; RIS, Cat. Coll. Sélys 12 (1911) 463.

The male of this species is strikingly marked by blackish wing tips, but the female is clear-winged, as are both sexes in the other species.

Hind wing, 17 to 19 mm.

LUZON, Ilocos Norte Province, Piddig, 2 males, January 7, 1931 (*Ignacio Valentin*).

DIPLACODES TRIVIALIS Fabricius. Plate 4, fig. 62.

FABRICIUS, Suppl. Ent. Syst. (1798) 284, Oriental India; SÉLYS, An. Soc. Esp. Hist. Nat. 11 (1882) 8, Philippines; RIS, Cat. Coll. Sélys 12 (1911) 468; NEEDHAM, Proc. U. S. Nat. Mus. 27 (1904) 708.

This is the species that fairly swarms in the lowlands of the Oriental Tropics.

When recently emerged the sides of the thorax are pale greenish yellow with three narrow irregular and more or less interrupted black lines on the sutures, the front is darker with a pale median stripe. Old specimens become wholly pruinose of body and blackish with only the face and the appendages at the end of the body remaining pale.

Specimens from every collector and every lowland locality.

DIPLACODES sp. Nymph.

Length, 15 mm; abdomen, 9; hind femur, 5; width of head, 5; width of abdomen, 5.5.

In 1904 [21] the senior author described a nymph of this genus by supposition from a large lot of very poor material—nymphs of all sizes dried on pins and mostly broken. Now we have a few more nymphs from Los Baños and Zamboanga, this time in alcohol, and again very badly preserved. In one of these the venation is well enough preserved to make certain that the

[21] Proc. U. S. Nat. Mus. 27 (1904) 708.

genus was rightly determined. Now we can give a few details not well shown in the dried and shriveled specimens.

Head wide with large and laterally prominent eyes and abruptly narrowed in the rear portion (as shown in the photo reproduced).[22] Labium (Plate 9, figs. 96 and 97) rather slender with very prominent triangular middle lobe, smooth of border, and sparsely fringed with setæ. Setæ ten to eleven lateral and twelve to thirteen mental. Movable hook very slender and regularly curved. Terminal border of lateral lobe faintly serrulate with single spinules on the serrulations.

Prothoracic disc scurfy pubescent on its rounded lateral margins. No distinct supracoxal process, instead a broad sloping pubescent area. Slender, nearly bare, legs faintly ringed with brown, wing cases mottled with the same color at base and at nodus.

Abdomen oval, moderately depressed, marked with two broad bands of brown that are interrupted by cross rings of paler color on the sutures. No dorsal hooks. The lateral spines on segments 8 and 9 minute but sharp and straight and well-defined. Abdominal segment 10 annular and almost included in the apex of 9. Appendages as long as 9 and 10 together on the middorsal line, with the laterals a fifth shorter than the others.

While the venation of the nymphal wings of our specimen were adequate for determination of the genus, the distinctive area about the stigma being well preserved, the portion about the subtriangle of the forewing that would have furnished characters to distinguish the two Philippine species had disintegrated.

RAPHISMIA BISPINA Hagen. Plate 6, fig. 77.

HAGEN, Stett. Ent. Ztg. 28 (1867) 91, Morotai, Halmaheira; RIS, Cat. Coll. Sélys 11 (1910) 369.

This little blackish, clear-winged dragon fly is easily recognized when teneral by its pattern of four broad, yellow, oblique stripes on the sides of the thorax, the first and third interrupted near both ends to form isolated spots above and below (a pattern that becomes entirely obscured by pruinosity in old males) and by the presence of a pair of conspicuous spines underneath the metathorax of the male; also by these venational characters in addition to those mentioned in our table of genera; the

[22] Op. cit., pl. 41, figs. 8 and 9.

triangle in the hind wings is situated far beyond the arculus and the anal loop is open at the toe, vein A_2 not being conjoined with A_1 at the end of the midrib (Plate 6, fig. 77).

Hind wing, 24 to 25 mm.

Nymph unknown.

LUZON, Manila, Maypajo, 10 males, June, 1930 (*A. C. Duyag*): Rizal Province, Navotas, 1 male, December 24, 1930 (*T. San Pedro*); Malabon, 1 male, January 2, 1935 (*A. C. Gallardo*): Bulacan Province, 2 males and 1 female, December 27, 1930 (*P. V. Cruz*): Pangasinan Province, San Carlos, 3 females, January 2, 1931 (*Dominador Santos*).

ZYGONYX IDA Karsch. Plate 7, fig. 83.

KARSCH, Berlin Ent. Ztsch. 33 (1889) 281; RIS, Cat. Coll. Sélys 14 (1912) 819, Java, Malacca, Sumatra, Lombok, Ekas, Sapit.

This is a clear-winged species of moderate size, with metallic green frons and dorsum when fully mature. It may be distinguished by the following combination of venational characters in addition to those shown in our table of genera: two rows of cells in the space beyond the forewing triangle out to the level of the nodus; vein Cu_2 in hind wing arises from the outer side of the triangle; a very long and much angulated anal loop, the midrib of which is bent at the ankle at an angle of about 90 degrees; antenodals of fore and hind wing twelve and a half and nine to ten, respectively (Plate 7, fig. 83).

Hind wing, 40 to 47 mm.

LUZON, female.

ACISOMA PANORPOIDES Rambur. Plate 7, fig. 86.

RAMBUR, Hist. Ins. Neur. (1842) 28, male, female; SÉLYS, An. Soc. Esp. Hist. Nat. 11 (1882) 8, Philippines; RIS, Cat. Coll. Sélys 12 (1911) 457; NEEDHAM, Zoologia Sinica (A) 11 fasc. 1 (1930) 177.

This species will be readily recognized by the unique form of the abdomen; the basal half greatly inflated, the apical half slender. Segments 7 to 10 black with white or pale appendages. Thorax and swollen base of abdomen pale bluish green with a complicated pattern of curving black lines.

Hind wing, 22 mm.

LUZON, Bulacan Province, Calumpit, 1 female, December 21, 1930 (*Fidel Reyes*): Laguna Province, Los Baños, 1 male, December 23, 1930 (*Vedasto Javier*); Bangyas Bay, 1 female, December 30, 1930 (*E. Carandang*): Batangas Province, Talisay, 1 male, December 30, 1930 (*A. P. Evangelista*), 1 female, December 30, 1931 (*Entomology I*).

The nymph was described and figured by the senior author in 1930.[23]

Genus DIPLACINA Brauer

This genus may be distinguished from its nearest allies by a simple venational character; the vein Cu_2 arises in the hind wing, not from the hind angle of the triangle but from its outer side. Also, the single bridge crossvein is situated extremely far forward, almost its own length before the subnodus. In the prothorax the posterior dorsal lobe is very high, bilobed, and fringed on its erect rounded margins with long hairs.

Three species, of moderate size, handsomely striped with black and yellow, are found in the Philippines. One of these, *D. nana*, we have not seen. Apparently it has not been collected since Semper obtained the two original specimens (Cebu, Bohol) that Brauer described in 1878.

Ris (1909) was clearly in error when he recognized but one additional Philippine species, relegating *D. braueri* to synonymy with *D. bolivari*. Karsch earlier (1889) correctly diagnosed the two species, pointing out some of their distinctive venational characters; but his very scanty material led him to cite differences that do not hold when a greater number of specimens are examined. He had but a single male of each. We have a long series of specimens of each. Both species seem to be common at Los Baños, *D. bolivari* perhaps a little more so than *D. braueri*. We have carefully compared venation and color pattern in more than fifty specimens of each, and find no difficulty in distinguishing them.

The nymph [24] also is easily recognizable by reason of its having, in *D. braueri* at least, lateral spines on segments 7, 8 and 9 of the abdomen, and not on 8 and 9 only, as in the other genera.

The three species may be distinguished as follows:

1. One row of cells in the space beyond the triangle..... *nana.*
   Two rows of cells in the space beyond the triangle..... 2.
2. One cubito-anal crossvein in the hind wing..... *braueri.*
   Two cubito-anal crossveins in the hind wing..... *bolivari.*

DIPLACINA BOLIVARI Sélys. **Plate 7, fig. 85.**

SÉLYS, An. Soc. Esp. Hist. Nat. 11 (1882) 15, male, Luzon; KARSCH, Berl. Ent. Zeitschr. 33 (1889) 379; RIS, Cat. Coll. Sélys 9 (1909) 97.

[23] Zoologia Sinica (A) 11 fasc. 1 (1930) 178, pl. 14, fig. 2.

[24] Lieftinck has doubtfully referred a Moluccan nymph to *Diplacina phœbe* Ris (Treubia 7: 323, pls. 8, 9). His good description and figures show far too many raptorial setæ on the labium, when compared with our nymphs, for close association with the nymphs we have been able to refer to *Diplacina* by characters of the developing venation.

This is a slightly larger species that in fully mature specimens becomes darker above and more pruinose on the underside of the thorax. The three black stripes of the sides of the synthorax are broader, especially the middle one which is complete below, and generally confluent at two intermediate places as well as at both ends with the one behind it (Plate 7, fig. 85). The two cell rows beyond the triangle generally begin with three cells next its outer side. There are two cubito-anal crossveins as noted in the key, and vein M_2 is distinctly undulate.

Hind wing, 33 to 39 mm.

DIPLACINA sp. Nymph (BOLIVARI supposition). Plate 9, figs. 114 and 115.

Length, 18 mm; abdomen, 10; hind femur, 5; width of head, 5; width of abdomen, 6.

This is an elongate nymph, approaching the *Orthetrum-Libellula* type, with eyes capping the anterolateral angles of the head only a little less prominently. The head only slightly wider across eyes than on the broadly rounded hind angles. Labium (Plate 9, figs. 114 and 115) large, with prominent evenly bordered median lobe very thickly beset with stout irregular spinules. Lateral setæ four or five; mentals four or five in an outer row that dwindles internally into a series of ten to fifteen smaller ones, these becoming irregular towards middle line of mentum. Teeth on terminal border of lateral lobe very low, eroded, many times wider than high and bearing each about half a dozen strong spinules. Prothoracic disc rather broad, its projecting ends densely clothed with long bristles. So also is the still broader supracoxal process beneath. Legs hairy. Wing cases reach well upon the sixth abdominal segment.

Abdomen elongate, oval, widest on segment 6, roundly tapered to rearward, with small lateral spines on 8 and 9, low, sharp, straight, subequal. No dorsal hooks. Segment 10 cylindric, half as long as 9 on the middorsal line. Appendages moderate, not as long as 9 and 10, superiors and inferiors of equal length; laterals slender, more sharply pointed, a fifth shorter.

DIPLACINA BRAUERI Sélys. Plate 7, figs. 84 and 87.

SÉLYS, An. Soc. Esp. Hist. Nat. 11 (1882) 15, Philippines; KARSCH, Berl. Ent. Zeitschr. 33 (1889) 379; RIS, Cat. Coll. Sélys 9 (1909) 97 (as *bolivari*).

This is the slightly smaller (hind wing 26 to 28 mm) and more brightly colored species. Of the three black stripes on the lateral sutures of the synthorax, the middle one is narrowed

and discontinued below the spiracle, or conjoined with the one before it only by a decurrent hair line (Plate 7, fig. 84).

Besides the single venational distinction used in our key, the absence of a second cubito-anal crossvein (a character which appears to be quite constant) there are two other good characters that were pointed out by Karsch:[25] the two rows beyond the triangle generally begin with but two cells touching its outer side, and vein M_2 is scarcely undulate, much less so than in *D. bolivari*. The numbers of nodal crossveins and of marginal cells given by him are inconstant and therefore not significant.

Nymph: (*Plate 9, fig. 113*).—Very similar in form to the preceding species, but differing in being a little smaller (length 16, abdomen 9) and lighter in color, and, more strikingly, in having larger and rather conspicuous lateral spines on abdominal segments 7 to 9, as shown in our figure. Minor differences in the labial characters; teeth on terminal border of lateral lobe of labium eroded to obsolescence and their marginal spinules alternately long and short; mental setæ but three in the outer group, with a scattering line of much smaller and more numerous spinules extending inward.

DIPLACINA sp?

We have a single female specimen in which there is a single cell in this area touching the triangle, and also a one-celled interruption of the two rows three cells farther out in the wing: also there is a subtriangle in the forewing of one side divided into only two cells; but the arcuate dividing crossvein suggests something omitted. The other forewing is missing from this specimen. The black stripes of the sides are much as described above, but the humeral yellow stripe is broader and interrupted before the crest. Within the antealar sinus a pair of bright yellow spots lie opposite the two that are forward from the detached upper end of the humeral stripes. Is it another species?

Genus BRACHYDIPLAX Brauer

Two species of this genus of rather small dragon flies are recorded from the Islands, but only one of them has been before us. The genus will be recognized by the venational characters shown in our table, and perhaps by the following additional characters: There are wide spaces without crossveins behind

[25] Berl. Ent. Zeitschr. 33 (1889) 379.

the stigma and before it in the same (R_1) space, the radial planate is continuous to the wing margin, the triangle of the hind wing is retracted almost to the arculus but generally not quite touching it, and the large first anal cell next the membranule is emarginate by a reëntrant curve on its posterior side. Both species have seven antenodal crossveins in the forewing. The two species may be separated as follows:

1. Subtriangle of the forewing 3-celled..... *chalybea.*
   Subtriangle of the forewing 1- or 2-celled..... *duivenbodei.*

BRACHYDIPLAX CHALYBEA Brauer. Plate 6, fig. 80.

BRAUER, zool.-bot. Wien 18 (1868) 173, Bohol; SÉLYS, An. Soc. Esp. Hist. Nat. 11 (1882) (*chalybæa*); RIS, Cat. Coll. Sélys 11 (1910) 363; NEEDHAM, Zoologia Sinica (A) 11 fasc. 1 (1930) 175, nymph.

Dark species, metallic blue on top of frons, and also in the dorsum of the thorax of the males. Sides clouded rather than striped with paler on the convex areas between the dark sutures. Old specimens become blackish over whole abdomen. Base of both wings washed with brown over two or three cells outward.

Hind wing, 27 to 30 mm.

LUZON, Laguna Province, Los Baños, 1 male, August 31, 1930 (*M. E. Rosell*), 1 male, February 15, 1931 (*M. R. Viloria*), 1 female, August, 1932 (*A. Muyco*), 1 male, November 11, 1933 (*Prisco Caraig*); Raymundo Barrio, 1 female, October (*Leoncia L. Serrano*); Pila, 2 males and 1 female, January 1, 1931 (*J. K. Santiago*); Molawin Creek, 1 female, February 14, 1934 (*Z. T. Neri*); Mount Maquiling, 2 males, no date (*Baker*): Ilocos Norte Province, Laoag, 1 male, January 2, 1931 (*Manuel Asuncion*). MINDANAO, Zamboanga Province, Kabasalan, 16 males, April, 1932 (*H. C. Muzzall*), 3 males, July, 1932 (*H. C. Muzzall*).

BRACHYDIPLAX DUIVENBODEI Brauer.

BRAUER, zool.-bot. Wien 16 (1866) 569, a male, New Guinea; SÉLYS, An. Soc. Esp. Hist. Nat. 11 (1882) 8, Bohol; RIS, Cat. Coll. Sélys 11 (1910) 365.

We have not seen this species. The single known specimen is reported by Ris [26] to have an extra half antenodal in one forewing.

Genera MACRODIPLAX Sèlys and UROTHEMIS Brauer

Here is superficial likeness between representatives of two distinct genera. Both are reddish brown, black-legged dragon flies of similar size, nonpruinose when adult, with little color

[26] Cat. Coll. Sélys 11 (1910) 365.

pattern on the villous thorax, with broad black middorsal stripe on the abdomen, and a spot in the base of the hind wing. This spot is large, blackish and gold-bordered in *Urothemis,* smaller and all golden in *Macrodiplax.* The antenodal crossveins are 7 in *Urothemis,* 6 in *Macrodiplax.* In *Macrodiplax* the reverse crossvein is extremely aslant and about twice as long as the crossvein in its proximal side, much less so in *Urothemis.* The forewing triangle is more convex on its distal side and the "toe" of the anal loop is more pointed in *Macrodiplax.*

MACRODIPLAX CORA Brauer. Plate 5, fig. 69.

BRAUER, zool.-bot. Wien 17 (1867) 20, 289, Ceram, Philippines; SÉLYS, An. Soc. Esp. Hist. Nat. 11 (1882) 15; RIS, Cat. Coll. Sélys 16 (1913) 1036.

Hind wing, 35 mm.

Specimens from practically all localities.

UROTHEMIS BISIGNATA Brauer. Plate 5, fig. 70.

BRAUER, zool.-bot. Wien 18 (1868) 175, 737, female, Luzon; SÉLYS, An. Soc. Esp. Hist. Nat. 11 (1882) 15; RIS, Cat. Coll. Sélys 16 (1913) 1025.

Hind wing, 35 mm.

There are 23 females and 15 males from Laguna, Rizal, Pampanga, Pangasinan, Nueva Ecija, Bulacan, Isabela, Batangas, and Tarlac Provinces, Luzon, collected by F. M. Fronda, B. G. Salinas, J. M. de Vera, V. Labayen, A. P. Varona, F. S. Manipol, Melchor Dugus, Clemente Valdez, P. M. Caguicla, W. Macapagal, Rodrigo Odes, Jacinto Lagtapon, F. C. Francisco, V. Gagolinan, A. P. Evangelista, I. Villanueva, G. Mejia, T. Oliquino, C. Magno, Domingo Fermin, J. K. Santiago, W. Figueroa, H. Angel, S. R. Roque, F. A. Caña, Mariano Magtang, A. P. Bayan, Bartolome Javier, "Entomology I."

Genus ZYXOMMA Rambur

Two species are represented in the material before us. Both are rather plain brown dragon flies of medium size with narrow black apical carinæ on the middle abdominal segments. They are distinguished from related genera by the open "toe" of the anal loop: vein A_2 does not join A_1 at the end of the midrib in the usual manner but runs out independently to the wing margin. The two may be distinguished as follows:

1. Abdomen longer than hind wing..... *petiolatum.*
   Abdomen at most as long as hind wing..... *obtusum.*

ZYXOMMA PETIOLATUM Rambur. Plate 7, fig. 81.

RAMBUR, Hist. Ins. Neur. (1842) 30, pl. 2, fig. 4*d*, male, Bombay; RIS, Cat. Coll. Sélys 15 (1913) 903.

This species has the abdomen bulbous at the base and exceedingly attenuated beyond. Two dashes of tawny yellow color in the base of each wing, and sometimes a wash of pale brownish across the wing apex, mark the otherwise generally hyaline wing membrane. Stigma pale.

Hind wing, 32 to 33 mm.

LUZON, Laguna Province, Los Baños, male, July 7, 1931 (*M. Enriquez*), male, February 10, 1932 (*J. Reyes*), female, February 20, 1932 (*P. Asuncion*).

ZYXOMMA OBTUSUM Sélys.

SÉLYS, Mitt. Mus. Dresden (1878) 293; Celebes; RIS, Cat. Coll. Sélys 15 (1913) 908.

In this species the abdomen is relatively shorter and stouter, the constriction at the end of the third segment being less close and the portion beyond less narrowed. In most specimens, but not in all, the wing tips are brown from the level of the proximal end of the stigma, but in one female from Kabasalan, Zamboanga, they are wholly tinged with brown.

Hind wing, 38 to 40 mm.

LUZON, Laguna Province, Los Baños, female, August 3, 1932 (*A. B. Barroquillo*), male, August 20, 1932 (*Gregorio A. Jaime*); Mount Maquiling, female (*Baker*); Raymundo Barrio, female (*Leoncia Serrano*). MINDANAO, Zamboanga, Kabasalan, 4 males and 1 female (*H. C. Muzzall*).

THOLYMIS TILLARGA Fabricius. Plate 8, fig. 91.

FABRICIUS, Suppl. Ent. Syst. (1798) 285, Oriental India; SÉLYS, An. Soc. Esp. Hist. Nat. 11 (1882) 6, Manila; RIS, Cat. Coll. Sélys 15 (1913) 913.

This wide-ranging species is easily recognized by a large cloud of yellowish or brownish color occupying most of the basal half of the hind wing (there is a whitened area beyond it in old specimens) with a fainter wash of yellow in the basal third of the forewing. The body is yellowish brown, possibly olivaceous in life, almost destitute of color pattern.

Hind wing, 36 mm.

There are 33 males and 32 females from Laguna, Tarlac, Rizal, Pampanga, and Cagayan Provinces, Luzon, collected by F. O. Panis, L. Boongaling, Restituto B. Realeza, Eufemio Salera, Modesto M. Ragat, Pablo B. Agcanas, Santos S. Garcia, Felix Bau-

oag, Manuel A. Aaron, F. J. Madrid, I. A. Cabauatan, Isidro Dumaua, G. A. Pangga, L. S. Gonzales, Rodrigo Odes, G. O. Palis, P. Rosales, Jose David, Domingo Endrinal, Rudyardo Santiago, P. M. Caguicla, T. Faysan, I. Villafuerte, J. Amores, Rodolfo Guerrero, R. Baes, M. R. Viloria, C. Antenor, M. Enriquez, Domingo Fermin, H. Angel, Celerino Gariando, T. Catlazo, Hilario J. Santos, J. S. Versoza, Ruperto Cabahug, P. Enrile, F. Briones, Tomas Carag, Federico Deximo, I. Villanueva, McGregor, Baker, Duyag, A. Celestino, and R. Denoga, in all months of the year except April, May, June, and July. MINDANAO, Zamboanga Province, Kabasalan, 13 males (*Muzzall*).

THOLYMIS sp. Nymph. Plate 9, figs. 116 to 118.

Length, 23 mm; abdomen, 15; hind femur, 7; width of head, 6; width of abdomen, 9.

A smooth, slender-legged nymph with strongly triquetral abdomen, the flat sides sloping like a roof to the serrated dorsal ridge. Head rather small with the moderately large eyes prominent at the middle of sides. Behind the eyes the sides converging to a rather wide, slightly concave occipital border. Labium (Plate 9, figs. 116 and 117) freckled with brown, its hinge reaching backward to the middle of the mesothorax. Lateral setæ eight, mentals eleven on each side. Teeth on the distal border of the lateral lobe eight, deeply and very obliquely cut, nearly as high as wide, each of the middle ones armed with four or five stout spinules. Movable hook large, strong, and curved only towards the tip.

Prothorax moderate, its disc rather wide, and with a thickened, upturned, and hair-fringed margin. Below it and in front of it a long, stout, blunt, pyramidal, supracoxal process that is very hairy externally. Legs pale, thin, and sparsely hairy; femora and tibia each faintly and doubly ringed with brown. Wing sheaths with a brown dot at the nodus.

Abdomen beyond the tips of the wings with a middorsal band of brown divided by a paler line along the median ridge. Sides faintly washed and mottled with brown farther towards the lateral margin. Lateral spines on segments 8 and 9, sharp, straight, subequal, each about a fifth as long as its segment. Lateral margin of these segments distinctly serrulate. Dorsal hooks on 4 to 10 small and erect on 4, becoming successively wider and flatter and more strongly declined to rearward on 5 to 9, a low vestige on 10. Segment 10 nearly cylindric, a little flattened on the sides, a third as long as 9 on the middorsal line.

Appendages very long, straight, and sharply triquetral. Superior and inferiors of equal length, distinctly longer than 9 middorsally; laterals slender and about half as long as the others.

This differs from the nymph from Batangas,[27] in having eight raptorial setæ instead of five on the lateral lobe of the labium, but otherwise quite similar. Venation of nymphal wings well enough preserved for assured generic identification.

The nymph figured by Fraser [28] as belonging to this species was clearly in error, as was also the one referred to *Tramea limbata* on the same plate.

RHYOTHEMIS PHYLLIS Sulzer. Plate 5, fig. 71.

SULZER, Ab. Ges. der Ins. (1776) 169, "Indient;" SÉLYS, An. Soc. Esp. Hist. Nat. 11 (1882) 7, Luzon, Cebu, Bohol; RIS, Cat. Coll. Sélys 15 (1913) 939.

This elegant species is easily recognized by its yellowish-tinted wings that are handsomely marked with brown as follows: A band across the tips beyond the stigma, a small spot on the nodus of the forewing, and two large spots on the base of the hind wing separated by light yellow. The spot nearer the hind angle is very variable in extent and may be wanting. In well-colored specimens it is very prominent, being surrounded by bright yellow.

Hind wing, 31 to 37 mm.

The nymph is unknown.

LUZON, Laguna Province, Los Baños, 1 female, February 28, 1931 (*B. Orig*), 1 female, January 7, 1932 (*M. Aldama*), 1 female, February 16, 1932 (*I. Villanueva*), 1 male, February 16, 1932 (*P. Cabreros*), 2 males and 4 females, no collector: Pangasinan Province, Mangaldan, 1 male, December 25, 1930 (*A. F. Cortes*); San Carlos, 1 female, December 28, 1930 (*Mariano Magtang*). SAMAR, Oquendo, 1 male, December 30, 1931 (*F. Reformina*). MINDANAO, Zamboanga, Kabasalan, 3 males, July, 1932 (*Muzzall*).

Genus NEUROTHEMIS Brauer

This colorful genus is easily recognized by the rich red-brown of the wings of the males and by the riot of crossveins in them. The two known Philippine species have the wings of the male

[27] Described by the senior author, Proc. U. S. Nat. Mus. 27 (1904) 701, as *Rhyothemis phyllius* supposition.

[28] Rec. Ind. Mus. 26 (1924) pl. 32, fig. 2.

suffused with brown from base to stigma. They may be distinguished as follows:

1. Brown area of wings of male squarely truncated at the base of stigma in both wings: two cubito-anal crossveins in hind wing..... *terminata.*
   Brown area in hind wing abbreviated on posterior side and rounded externally: generally a single cubito-anal crossvein in hind wing. *palliata.*

The females of *N. terminata* are dimorphic. One form is colored like the male but less intensively; the other has subhyaline wings, and much more open venation. Females of *N. palliata* have the brown area of the wings terminating about midway between the nodus and the stigma.

NEUROTHEMIS TERMINATA Ris.

RAMBUR, Hist. Nat. Neur. (1842) 127 (*Polyneura apicalis*) Java; SÉLYS, An. Soc. Esp. Hist. Nat. 11 (1882) 8; RIS, Cat. Coll. Sélys 13 (1911) 569.

Specimens from all localities.

NEUROTHEMIS PALLIATA Rambur. Plate 5, fig. 66.

RAMBUR, Hist. Nat. Neur. (1842) 129, East Indies; SÉLYS, An. Soc. Esp. Hist. Nat. 11 (1882) 7; RIS, Cat. Coll. Sélys 13 (1911) 554.

Specimens from all localities.

NEUROTHEMIS sp. Nymph No. 1. Plate 9, figs. 101 and 102.

Length, 15 mm; abdomen, 9; hind femora, 5; width of head 5; width of abdomen, 6.

A stocky little nymph with rather large head, and prominent, roundly bulging eyes. Behind the eyes the head narrowing rapidly to a rather straight occipital border, down which run seven streaks of brown. Labrum and free border of frons and a spot behind the base of each antenna also brown. Labium ample, its hinge reaching the middle of the mesothorax; with nine lateral setæ and twelve mentals; teeth obsolete, represented by tufts of spinules.

Prothoracic disc crescentic, its low incurving end margins armed with a row of stout decurving setæ. Coxæ and low supracoxal processes bear tufted weaker setæ. Legs slender spinulose, especially the outer side of the tibiæ; femora pale, twice ringed with brown. Wing cases reach the tip of the sixth abdominal segment.

Abdomen oblong, somewhat depressed, widest on segment 6, most narrowed on 9; with a middorsal ridge that is pale, not

rising into hooks with free tips. Sharp subequal spines terminate the lateral margins of 8 and 9, each as long as half the middorsal length of 9. Appendages sharply pointed, superior almost equal to inferiors in length, these very spinous beneath, the slender and pale laterals a fifth shorter.

NEUROTHEMIS sp. Nymph No. 2.

A second species of nymph of this type appears to differ by having a broad pale median facial stripe extending down in the labrum, by lacking the white line on the middorsal ridge of the abdomen, by having the raptorial setæ of the labium eleven on both lateral lobe and mentum each side, by having the lateral spines of segments 8 and 9 very unequal, those of 8 being shorter.

CAMACINIA GIGANTEA Brauer. Plate 8, fig. 92.

BRAUER, zool.-bot. Wien 17 (1867) 8, male, female, Amboina; MATIN, Mission Pavie (1904) 4, Philippines: TILLYARD, Proc. Linn. Soc. N. S. Wales 33 (1908) (as *C. othello*); RIS, Cat. Coll. Sélys 15 (1913) 925–928.

This species is easily recognized by its size, it being the largest of the libellulines, and by the black color of the basal half of both wings. Venationally it is distinguished by having three rows of cells above the radial planate, the latter with its distal end upturned and strongly conjoined with vein Rs.

Hind wing, 47 to 52 mm.

LUZON, "Tolands," 1 male. POLILLO, 1 male (*Baker*).

The specimen from Luzon fits the description of *C. othello* Tillyard, having the black area in the forewing hardly surpassing the nodus, and in the hind wing extending diffusely but one cell beyond. The Polillo specimen fills the gap between that and the *C. gigantea* figured by Ris,[29] showing the extent of the black to be variable, as are the body colors as well, and no proper basis for species recognition.

TRAMEA LIMBATA Desjardins. Plate 8, fig. 89.

DESJARDINS, Rapport Société Maurice (1) (1832), Mauritius; CABOT, Mem. Mus. Comp. Zool. 17 (1) (1890) 48; NEEDHAM, Proc. U. S. Nat. Mus. 27 (1904) 712, fig. 4; RIS, Cat. Coll. Sélys 16 (1913) 979.

This fine wide-ranging, strong-flying dragon fly appears not to have been reported from the Philippines hitherto, and but two specimens are in the collections before us. It is difficult to capture. It will be readily recognized by its large size, and by the extreme breadth at base of the hind wings, with a broad trans-

[29] Cat. Coll. Sélys 15 (1913) 924, fig. 535.

verse band of dark brown covering most of the area behind vein A_2 adjacent to a whitish membranule.

Hind wing, 45 mm.

The nymph was described by Cabot in 1890 [30] and figured by the senior author in 1904.[31]

LUZON, Laguna Province, Los Baños, male, November 10, 1932 (*I. Villanueva*) : Benguet Subprovince, Baguio, male (*Baker*).

HYDROBASILEUS CROCEUS Brauer. Plate 7, fig. 82.

BRAUER, zool.-bot. Wien 17 (1867) 813, male, Luzon; SÉLYS, An. Soc. Esp. Hist. Nat. 11 (1882) 7; RIS, Cat. Coll. Sélys 16 (1913) 969; FRASER, Mem. Dept. Agr. India 8 (1924) (8) 71, fig.

This fine large yellowish-brown species is easily recognized by a big brown irregular blotch that covers in part the "foot" of the anal loop (not wholly covering the remarkably bulging "heel") and extends to the hind angle of the wing. Veins M_3 and M_4 converge outward to the point where they rather sharply bend to rearward.

Hind wing, 45 mm long; greatest width, about 11 or 12 mm.

The nymph was described and figured by Fraser in 1924.[32] It may be readily distinguished by the strange, rearwards-produced cone-shaped eyes.

One male, without specific locality label, probably Los Baños.

PANTALA FLAVESCENS Fabricius. Plate 8, fig. 90.

FABRICIUS, Suppl. Ent. Syst. (1798) 285, India; SÉLYS, An. Soc. Esp. Hist. Nat. 11 (1882) 6, Philippines; RIS, Cat. Coll. Sélys 15 (1913) 917.

This robust strong-flying cosmopolitan dragon fly is easily recognized by a combination of characters: The stigma is trapezoidal, vein M_2 is strongly undulate, and there is a second cubito-anal crossvein in the hind wing forming there a distinct subtriangle. Also, there are extra transverse carinæ on the slightly swollen basal segments of the abdomen, and the entire basal area of the hind wings is flavescent.

Hind wing, 41 mm.

A photograph of the nymph was published by the senior author in 1904.[33]

Specimens from practically all localities.

[30] Mem. Mus. Comp. Zool. 17 (1890) (1) 48.
[31] Proc. U. S. Nat. Mus. 27 (1904) 712, pl. 40, fig. 4.
[32] Mem. Dept. Agr. India 8 (1924) (8) 71, fig.
[33] Proc. U. S. Nat. Mus. 27 (1904) pl. 40, fig. 5.

Genus ORTHETRUM Newman

The five well-known species of this genus occurring in the Philippines may be distinguished as follows:

1. Triangle of hind wing usually free from crossveins ..... 2.
   Triangle of hind wing crossed ..... 4.
2. Vein C_2 in hind wing arises from hind angle of triangle ..... *glaucum.*
   Vein Cu_2 in hind wing arises from outer side of triangle ..... 3.
3. Sides of synthorax almost concolorous; swollen basal abdominal segments but little compressed ..... *luzonicum.*
   Sides of synthorax marked with four or five distinct stripes; swollen basal abdominal segments very strongly compressed ..... *sabina.*
4. Basal wing spots of male blackish; top of frons blackish in male; body becoming very pruinose with age; first three segments of abdomen black, followed by lighter color ..... *clelia.*
   Basal wing spots of male golden or reddish brown; top of frons reddish; entire abdomen concolorous ..... *testaceum.*

ORTHETRUM GLAUCUM Brauer.

BRAUER, zool.-bot. Wien 15 (1865) 1012, Balangodde, Ceylon; RIS, Cat. Coll. Sélys 10 (1909) 233.

Hind wing, 34 to 40 mm.

LUZON, Laguna Province, Los Baños, 2 males: Tayabas Province, Candelaria, 1 female, June 25, 1930 (*McGregor and Rivera*): Mountain Province, Baguio, 1 male (*Baker*). "Planta," 1 male, July 10, 1932 (*Leon Milapiup*).

ORTHETRUM LUZONICUM Brauer.

BRAUER, zool.-bot. Wien 18 (1868) 169, 732, Luzon; SÉLYS, An. Soc. Esp. Hist. Nat. 11 (1882) 11; RIS, Cat. Coll. Sélys 10 (1909) 210.

Hind wing, 29 to 34 mm.

LUZON, Mountain Province, Baguio, 1 male (*Baker*).

ORTHETRUM SABINA Drury. Plate 6, fig. 76.

DRURY, Ill. Exot. Ins. 1 (1770) 114 (pars), China; SÉLYS, An. Soc. Esp. Hist. Nat. 11 (1882) 8, Philippines; RIS, Cat. Coll. Sélys 10 (1909) 223.

Hind wing, 30 to 35 mm.

Specimens from all localities and all collectors.

ORTHETRUM CLELIA Sélys.

SÉLYS, Mitth. Mus. Dresden (1878) 294, 313, male, female, Menado, Moluccas, Luzon; An. Soc. Esp. Hist. Nat. 11 (1882) 11; RIS, Cat. Coll. Sélys 10 (1909) 242.

Hind wing, 37 to 41 mm.

LUZON, Manila, 2 males, June, 1930 (*McGregor et al.*): Cavite Province, Indang, 1 female, December, 1930 (*P. Erce*): Tayabas Province, Lucban, 1 female, January, 1931 (*F. Rivera*);

Mount Banahao, 2 males and 1 female, May, 1933 (*A. Y. Coronel*): Laguna Province, Los Baños, 1 male, February, 1930 (*B. Dalid*), 1 male, December, 1930 (*C. T. Mamon*), 1 male, January, 1931 (*D. Fermin*), 1 male, February, 1931 (*T. Oliquino*); 1 male, July, 1932 (*A. P. Evangelista*), 1 male, September, 1932 (*B. Utzurrum*), 1 male, 1930 (no collector); Planta, 5 males, August, 1932 (*Leon M. Capinpin*); Majayjay, Uube, 3 males (*McGregor and Celestino*). MINDANAO, Zamboanga Province, Kabasalan, 1 male and 2 females, July, 1932 (*Muzzall*).

ORTHETRUM TESTACEUM Burmeister.

BURMEISTER, Handb. Ent. 2 (1839) 859, Java; SÉLYS, An. Soc. Esp. Hist. Nat. 11 (1882) 12, Philippines; RIS, Cat. Coll. Sélys 10 (1909) 235.

Hind wing, 31 to 37 mm.

LUZON, Laguna Province, Los Baños, 1 male, February, 1930 (*G. Pangga*), 1 male, March, 1931 (*A. Felix*), 1 male, July, 1931 (*J. Saddul*), 1 female, February, 1932 (*P. Cabreros*), 1 male, June, 1932 (*Jaime Reyes*), 2 males, no date, no collector; Uube, 1 male, April, 1930 (*McGregor and Celestino*): Cagayan Province, Pina Blanca, 1 male, no date, no collector: Rizal Province, Novaliches, 1 male, July, 1930 (*McGregor*), 1 male, November, 1930, no collector, 1 male, December, 1930, no collector; Makabud, 1 male, June, 1930, no collector; Montalban, 1 male, May, 1931, no collector. SAMAR, Samar Province, Oquendo, 1 male, December, 1931 (*F. Reformina*). MINDANAO, Davao Province, Mati, 1 male, May, 1927, no collector: Zamboanga Province, Kabasalan, 8 males and 2 females, July, 1932 (*H. C. Muzzall*).

ORTHETRUM sp. Nymphs. Plate 9, figs. 103 to 109.

The nymphs of several species that may belong to this genus are included in the materials sent us. Unfortunately in none of them is the venation of the wings well enough preserved to aid in the determination of the species.

All agree in having elongate and more or less hairy bodies, and squarish heads with the eyes set far forward and prominently elevated at their anterolateral angles. This form is shown for a nymph from Java in a photograph published by the senior author[34] under the name *Orthetrum lepturum* (= *sabinum*) (supposition). It will suffice here to indicate the principal differences between the three sent us.

[34] Proc. U. S. Nat. Mus. 27 (1904) pl. 41, figs. 4, 5.

No. 1 (Plate 9, figs. 105 and 106) has eight lateral setæ, and a broken series of mentals seven of which are in an external line and five additional internals in a line almost at right angles to the seven with two small inner ones out of line. The ten teeth on the terminal border of the lateral lobe are serrate and truncate, hardly wider than high, and the middle ones bear each three or four graduated spinules. Abdominal segment 10 is very short, less than half of 9.

This genus is the one most abundantly represented in the nymph material sent us. It resembles most closely the Javanese nymph referred to above.

LUZON, Laguna Province, Los Baños, Molawin Creek, 1 nymph, June 18, 1930.

No. 2 (Plate 9, figs. 108 and 109) has six lateral setæ, and a series of three weak mental setæ, placed well towards the lateral margin and after an interval followed by a line of short numerous setæ ending in a median patch of spinules. The eight teeth on the terminal margin of the lateral lobe are lower, twice as wide as high, and bear shorter spinules. The border of the median lobe is more deeply crenulate. Abdominal segment 10 is about half the length of 9. This nymph is more densely hairy than the others.

MINDANAO, Zamboanga Province.

No. 3 (Plate 9, figs. 103 and 104) has five lateral setæ, and three mentals set far out, as in No. 2, followed internally by a somewhat stronger series of smaller setæ, at first in line and then scattering. The eight teeth on the terminal border of the lateral lobe are nearly obsolete, especially towards the inner angle, and the spinules on them likewise. Abdominal segment 10 is longer than half of 9.

MINDANAO, Zamboanga Province, many nymphs, all sizes.

Genera LATHRECISTA Kirby and POTAMARCHA Karsch

These two genera present a singular similarity in superficial appearance coupled with excellent differential structural characters. Both have the yellow sides of the synthorax obliquely traversed by a YIY-pattern of black stripes, and the black dorsum traversed by a broad yellow middorsal stripe that is narrowly divided by a black-edged middle carina. Both have brown wing tips but the brown in *Potamarcha* is less extensive, not reaching back to the stigma. Both have metallic blue frons with the face yellow beneath it, and both are of similar slender stature.

Lathrecista is readily distinguished from *Potamarcha* by lacking a crossvein in the triangle of the hind wing, by having the vein M_2 less strongly undulate, by having the nodus a little farther out in the forewing, by having both wings a little less narrowed beyond the level of the nodus, and by the following sex characters: In the male the anterior branch of the genital hamule is long, erect, and curved only at the tip, while in *Potamarcha* it is low and hooked, and inconspicuous. In the female the lateral margins of abdominal segment 8 are normal, while in *Potamarcha* they are expanded into conspicuous leaflike lobes. In the female of *Lathrecista* both the sternum and the posterolateral angles of abdominal segment 9 are prolonged beneath segment 10 (the sternum beyond its tip) while these parts in *Potamarcha* are unmodified.

With age *Lathrecista* acquires but little pruinosity, while old males of *Potamarcha* may have the color pattern entirely obscured by it.

LATHRECISTA ASIATICA Fabricius. Plate 6, fig. 73.

FABRICIUS, Ent. Syst. Suppl. (1798) 283, Oriental India; RIS, Cat. Coll. Sélys 10 (1909) 130.

LUZON, Laguna Province, Los Baños, 1 female, July 3, 1932 (*A. B. Baroquillo*), 1 male, no date, no collector; Uube, 1 male, May 8, 1930 (*McGregor et al.*); Mount Maquiling, 1 male, May 30, 1930, no collector; Tayabas Province, Sariaya, 1 male and 1 female, January 4, 1930 (*I. V. Torres*): Rizal Province, Novaliches, 2 males, May 9, 1930 (*A. C. Duyag*), 1 male, May 21, 1930 (*A. C. Duyag*), 1 male, July or August, 1930 (*A. C. Duyag*), 3 males and 2 females, no date, no collector; Makabud, 1 male, June 28, 1930, no collector: Manila, 6 males, June 7, 1930 (*McGregor et al.*): Pampanga Province, Arayat, 1 male, December 28, 1930 (*G. Mejia*): Bulacan Province, Ipo, 1 male, June 26, 1930, no collector: Batangas Province, Tanauan, 2 males, September 10, 1932 (*Pablo Aala*): "Luzon Cretas," 1 male and 1 female, June 3, 1931, no collector: "Luzon," 1 female, no date, no collector. MINDANAO, Zamboanga Province, Kabasalan, 8 males and 1 female, May, 1932 (*Muzzall*), 1 male and 1 female, July, 1932 (*Muzzall*).

POTAMARCHA OBSCURA Rambur. Plate 6, fig. 74.

RAMBUR, Hist. Ins. Neur. (1842) 64, male, female, "Indies"; KARSCH, Berlin Ent. Ztschr. 33 (1890) 371; RIS, Cat. Coll. Sélys 10 (1909) 156.

LUZON, Rizal, Batangas, Cagayan, Isabela, Nueva Vizcaya, Nueva Ecija, Laguna, Tayabas, Bulacan, and Pangasinan Prov-

inces, 68 males and 41 females, all months (*Tomas Carag, Conrado C. Dinulos, Felix Bauoag, Gregorio A. Jayme, Pablo Aala, M. Allen, A. C. Duyag, Pedro Cabreros, M. R. Viloria, J. V. Torres, A. Flores, A. P. Afalla, P. M. Caguicla, Cenon Flor Cruz, J. P. Capili, Baker, A. Celestino, F. A. Caña, T. Faysan, Teofilo Rivera, N. C. Reyes, Amado E. Costes, Marcelo Abelardo, F. T. Aala, I. Cayañga, Elias Lantion, C. Tantoco, A. Barroquillo, Miguel Alba, D. Villadolid, A. Malabayabas, C. Magno, F. Dumaguing,* and *McGregor*). SAMAR, Oquendo, 1 male, December (*F. Reformina*). MINDANAO, Zamboanga Province, Kabasalan, 19 males and 9 females, April, May, July (*Muzzall*).

ONYCHOTHEMIS ABNORMIS Brauer. Plate 7, fig. 88.

BRAUER, zool.-bot. Wien 18 (1868) 170, male, female, Luzon; RIS, Cat. Coll. Sélys 14 (1912) 833.

The long smooth claws that suggested the name of this genus are distinctive, as are also the long strong spines of the tibiæ. The claws lack the usual inferior denticle or terminal cleft. The metallic coloration of the front of the thorax and the white ringed sides of the very much swollen basal abdominal segments are also characteristic.

Hind wing, 42 mm.

LUZON, Laguna Province, Mount Maquiling, male, June 9, 1932: Nueva Vizcaya Province, Dupax, female, December 31, 1930 (*M. R. Viloria*).

Genus TRITHEMIS Brauer

The rather small, very dainty dragon flies of this genus are abundantly represented in the Philippines by three species that may be recognized by the venational characters given in our table of genera, and that may further and perhaps more easily be distinguished by color characters as follows:

1. Veins and stigma reddish; the yellowish area at base of hind wings extends outward to the triangle; frons red above; antenodal crossveins of fore and hind wings about twelve and one half and ten, respectively ..... *aurora.*

   Veins and stigma brownish, the latter pale at the ends; yellowish area at base of hind wings small, not reaching the triangle; frons above brownish; antenodals about eight and one half and six, respectively. *pallidinervis.*

   Veins and stigma blackish; the blackish area at the base of the hind wings extends outward to the triangle; frons above violet metallic when mature; antenodals about ten and one half and eight, respectively ..... *festiva.*

TRITHEMIS AURORA Burmeister. Plate 6, fig. 78.

BURMEISTER, Handb. Ent. 2 (1839) 859, Manila; SÉLYS, An. Soc. Esp. Hist. Nat. 11 (1882) 14; NEEDHAM, Proc. U. S. Nat. Mus. 27 (1904) 708, nymph; RIS, Cat. Coll. Sélys 14 (1912) 775.

This reddish species is represented in the collections before us by scores of specimens. The nymph was described and figured by the senior author in 1904 by supposition.[35]

Hind wing, 23 to 34 mm.

Specimens from all localities.

TRITHEMIS PALLIDINERVIS Kirby. Plate 6, fig. 79.

KIRBY, Trans. Zoöl. Soc. London 12 (1889) 327, India; SÉLYS, An. Soc. Esp. Hist. Nat. 20 (1891) 212, Philippines; RIS, Cat. Coll. Sélys 14 (1912) 789.

This is a yellowish species, in which the black stripes on the sides of the thorax and the pale spots on the dorsum of the abdomen are larger and plainer.

Hind wing, 30 to 32 mm.

LUZON, Laguna, Rizal, Ilocos Norte, Pangasinan, Pampanga, Tarlac, Nueva Vizcaya, Nueva Ecija, Bulacan, La Union, and Mountain Provinces, 43 females and 60 males, all months (*Baker, A. Sabado, Tomas Carag, Domingo Fermin, F. Y. Chan, E. Caguicla, F. de Leon Flores, N. Bartolome, C. B. Brizuela, A. Estocapio, V. Juan, R. Denoga, G. Mejia, Luciano Marzan, Fernando Lomboy, C. Manuel, A. F. Costes, A. C. Duyag, Pablo S. Garcia, Manuel Asuncion, Glicerio M. de las Alas, Rodolfo Guerrero, J. Taber, Jr., Gonzalo Villaflores, Bonifacio Espepe, Felix Arriola, D. P. Tabije, W. Macapagal, P. V. Cruz, L. Brawpley, Nicasio Garcia, A. Kabigting,* and *P. C. Gabertan.*

TRITHEMIS FESTIVA Rambur.

RAMBUR, Hist. Ins. Neur. (1842) 92, male, Bombay; SÉLYS, An. Soc. Esp. Hist. Nat. 11 (1882) 15, Luzon; RIS, Cat. Coll. Sélys 14 (1912) 796.

This shining black species has no color pattern showing in old specimens.

Hind wing, 26 to 32 mm.

LUZON, Ilocos Norte Province, Piddig, 2 males, January 7, 1931 (*Ignacio Valentin*). MINDANAO, Agusan Province, Santiago, male, April, 1931: Zamboanga Province, Kabasalan, 10 males, May, 1932 (*Muzzall*), male and female, July, 1932 (*Muzzall*).

[35] Proc. U. S. Nat. Mus. 27 (1904) 708, pl. 41, figs. 6, 7; pl. 44, fig. 1.

BRACHYTHEMIS CONTAMINATA Fabricius. Plate 4, fig. 65.

FABRICIUS, Entom. Syst. 2 (1793) 382, Oriental India; SÉLYS, An. Soc. Esp. Hist. Nat. 11 (1882) 15, Luzon; RIS, Cat. Coll. Sélys 13 (1911) 587; NEEDHAM, Zoologia Sinica (A) 11 fasc. 1 (1930) 149.

This small yellowish species will be recognized by the diffuse cloud of golden yellow covering the nodal area of the hind wing, and by the venational characters given in our table of genera.

Hind wing, 23 to 25 mm.

The nymph was described by the senior author in 1930 from China.[36]

Specimens from all localities.

Genus CRATILLA Kirby

The representatives of this genus may be recognized by this combination of venational characters: the arculus lies beyond the second antenodal crossvein; there are two or more bridge crossveins; the base of vein A_2 is opposite the anal crossing; and the vein Cu_2 in the hind wing arises from the hind angle of the triangle. The species may easily be distinguished as follows:

1. Wing tips brown: Rpl subtends one cell row..... *metallica.*
   Wing tips hyaline: Rpl subtends two cell rows..... *lineata.*

CRATILLA METALLICA Brauer. Plate 6, fig. 75.

BRAUER, Sitzgsber. Acad. Wien 77 (1878) 7, male, female, Malacca, Borneo, Sumatra; RIS, Cat. Coll. Sélys 10 (1909) 152.

This fine species is easily recognized by its shining metallic green color all over the body, its black labrum, its yellow labium with a broad-black median stripe, and its dark-brown wing tips.

LUZON, Laguna Province, Los Baños (?), male and female.

CRATILLA LINEATA Brauer.

BRAUER, Sitzgsber. Acad. Wien 77 (1878) 9, Malacca, Sumatra; SÉLYS, An. Soc. Esp. Hist. Nat. 11 (1882) 11, Mindanao; RIS, Cat. Coll. Sélys 10 (1909) 153.

This clear-winged species has a blackish thorax striped along the middorsal carina and dull yellow on the sides, and a yellow labrum and labium.

LUZON, Isabela Province, San Mariano, 1 female. MINDANAO, Davao Province, Mati, 1 male, March, 1927.

Genus LYRIOTHEMIS Brauer

This genus is represented in the collections before us by two species, one of which is new and one of which, the type of the

[36] Zoologia Sinica (A) 11 fasc. 1 (1930) 150.

genus, *L. cleis*, has long been known. These species may be distinguished from others in the fauna by the short, evenly tapering, strongly triquetral and dorsally carinate abdomen, shorter than the wings, by the presence of two or three cubito-anal crossveins in the hind wing, and by the sharply curved tips of veins M_3 and M_4.

LYRIOTHEMIS CLEIS Brauer. Plate 5, fig. 67.

BRAUER, zool.-bot. Wien 18 (1868) 181, 728, male, Mindanao; SÉLYS, An. Soc. Esp. Hist. Nat. 11 (1882) 9; RIS, Cat. Coll. Sélys 9 (1909) 108.

The two specimens of this species that have been before us are old females, blackish on head and thorax, red on the abdomen, and with metallic-green-capped frons.

Hind wing, 41 mm.

LUZON, Mount Banahao, 1 female, May 22, 1933 (*A. Y. Coronel*). MINDANAO, Zamboanga, Kabasalan, 1 female, July, 1932 (*Muzzall*).

LYRIOTHEMIS LATRO sp. nov. Plate 1, fig. 13.

Abdomen, 34 mm; hind wing, 43.

Allied to *L. tricolor* Ris, from Formosa, which is smaller and differs in numerous details.

Male.—Face yellowish, thinly clothed with brownish hairs, showing a little metallic luster on the darkened top of the frons in this teneral specimen; probably strongly metallic when fully mature. Labium wholly yellow except margin of lateral lobes. Lateral and superior marginal sutures of the face and vertex brown. Antennæ and hind margin of occiput brown. Rear of eyes black, invaded by a long trilobed spot of yellow.

Prothorax yellowish, washed with brown on the sides and faintly cross-streaked above with brown. Synthorax fuscous, broadly striped with yellow as follows: A very wide antehumeral stripe, laterally widened at both ends (below the crest and above the collar) several times wider than the narrow fuscous streak that borders on the middorsal carina; a stripe that nearly covers the metepisternum; another yet broader posterior one nearly covering the metepimeron. Antealar sinus yellow. Interalar sclerites mainly yellow, edged with brown. Legs blackish beyond the coxæ, with paler tarsi and claws. Wings (Plate 5, fig. 68) hyaline with only a touch of brown in the extreme base. Ante- and postnodal crossveins 14:9 and 11:8 in fore and hind wings, respectively. Triangle and supratriangles crossed in both wings. Three cells in the forewing subtriangle,

and three rows of cells in the space beyond the triangle. Three cubito-anal crossveins in the hind wing. Two bridge crossveins and two under the stigma.

Abdomen broad and regularly tapered from the third segment to the end, strongly triquetral and carinate middorsally, mainly pale (perhaps becoming red in life) with darkened carinæ and a pair of interrupted stripes of brown on the venter.

The anterior lamina of the second abdominal segment is low and nearly bare, broadly bilobed on its free margin with a rather wide rounded notch between the lobes. The large hamules are roughly pentagonal in form, with the inner posterior angle bearing a strong sharp hook (Plate 1, fig. 13).

The brownish superior terminal appendages arched upward and slender in their middle third, dilated towards both ends, the oval apical dilation ending in a mucronate outwardly directed point, underneath this portion a row of four or five denticles. The wider yellow inferior appendage almost as long as the superiors, truncated on the end where it bears a pair of erect black denticles.

Type.—Male. LUZON, Laguna Province, School of Forestry, Los Baños, Feb. 24, 1935 (*Raymundo Laher*).

This species is larger than any of the twenty members of this heterogeneous genus hitherto made known. It agrees very closely in venation with *L. tricolor* Ris except that it has a supratriangular crossvein in the hind wing that is wanting in that species. It differs in numerous details of coloration. It differs markedly from *L. cleis* Brauer by lack of the hooked tips of veins M_3 and M_4.

CROCOTHEMIS SERVILIA Drury. Plate 5, fig. 72.

DRURY, Ill. Ex. Ins. 1 (1770) 112, 113, pl. 47, fig. 6, China; SÉLYS, An. Soc. Esp. Hist. Nat. 11 (1882) 14, Luzon, Bohol; RIS, Cat. Coll. Sélys 13 (1911) 539; NEEDHAM, Zoologia Sinica (A) 11 fasc. 1 (1930) 151.

This is a stout, yellowish or reddish species, clear-winged except for a touch of golden brown at the extreme wing base, and without definite color pattern.

Hind wing, 33 to 35 mm.

The nymph was described and figured by the senior author in 1930.[37]

Specimens from all localities and collectors.

[37] Zoologia Sinica (A) 11 fasc. 1 (1930) 152, pl. 14, fig. 1.

ILLUSTRATIONS

PLATE 1

FIG. 1. *Ictinogomphus tenax* Sélys, male, lateral view of tip of abdomen. (Drawn by T. W. Lew.)
2. *Macromia negrito* sp. nov., male, dorsal view of tip of abdomen.
3. *Macromia negrito* sp. nov., male, lateral view of tip of abdomen.
4. *Gomphidia kirschii* Sélys, male, dorsal view of tip of abdomen.
5. *Gomphidia kirschii* Sélys, male, lateral view of tip of abdomen.
6. *Orogomphus splendidus* Sélys, male, lateral view of tip of abdomen; *d*, superior appendage; *e*, inferior appendage. (After Ris.)
7. *Orogomphus splendidus* Sélys, male, dorsal view of tip of abdomen. (After Ris.)
8. *Mesogomphus balneorum* sp. nov., male, lateral view of grasping organs of segment 2; *a*, anterior lamina; *b*, posterior hamule; *c*, anterior hamule.
9. *Heliogomphus bakeri* Laidlaw, male, dorsal view of tip of abdomen.
10. *Heliogomphus bakeri* Laidlaw, male, lateral view of tip of abdomen.
11. *Mesogomphus balneorum* sp. nov., male, lateral view of tip of abdomen.
12. *Mesogomphus balneorum* sp. nov., male, dorsal view of tip of abdomen.
13. *Lyriothemis latro* sp. nov., male, ventral view of grasping organs of segment 2.
14. *Heliogomphus bakeri* Laidlaw, female, ventral view of segment 9 and the subgenital plate; *f*, subgenital plate.
15. *Macromia negrito* sp. nov., female, sternites of segments 8, 9, and 10 to show subgenital plate.
16. *Idiophya salva* sp. nov., female, sternites of segments 8, 9, and 10.
17. *Agrionoptera bartola* sp. nov., female, sternites of segments 8, 9, and 10.
18. *Macromidia samal* sp. nov., female, sternites of segments 8, 9, and 10.
19. *Hemicordulia mindana* sp. nov., female, occiput.
20. *Hemicordulia mindana* sp. nov., female, lateral view of hamules.

PLATE 2

FIG. 21. *Anax gibbosulus* Rambur, male, dorsal view of tip of abdomen.
22. *Anax gibbosulus* Rambur, male, lateral view of tip of abdomen.
23. *Anax julius* Brauer, male, dorsal view of tip of abdomen.
24. *Anax julius* Brauer, male, lateral view of tip of abdomen. (After Martin.)

FIG. 25. *Anax guttatus* Burmeister, male, lateral view of tip of abdomen.
26. *Anax guttatus* Burmeister, male, dorsal view of tip of abdomen.
27. *Tetracanthagyna bakeri* Campion, female, ventral view of tip of abdomen.
28. *Tetracanthagyna bakeri* Campion, female, lateral view of tip of abdomen.
29. *Tetracanthagyna bakeri* Campion, male, dorsal view of tip of abdomen.
30. *Tetracanthagyna bakeri* Campion, male, lateral view of tip of abdomen.
31. *Indæschna baluga* sp. nov., male, lateral view of tip of abdomen.
32. *Indæschna baluga* sp. nov., male, dorsal view of tip of abdomen.
33. *Oligoæschna zambo* sp. nov., male, dorsal view of tip of abdomen.
34. *Oligoæschna zambo* sp. nov., male, lateral view of tip of abdomen.
35. *Gynacantha subinterrupta* Rambur, male, ventral view of anterior lamina.
36. *Gynacantha hyalina* Sélys, male, ventral view of anterior lamina.
37. *Gynacantha bayadera* Sélys, male, ventral view of anterior lamina.
38. *Gynacantha hyalina* Sélys, male, lateral view of tip of abdomen.
39. *Gynacantha hyalina* Sélys, male, dorsal view of tip of abdomen.
40. *Gynacantha subinterrupta* Rambur, male, lateral view of tip of abdomen.
41. *Gynacantha subinterrupta* Rambur, male, dorsal view of tip of abdomen.
42. *Gynacantha basiguttata* Sélys, male, lateral view of tip of abdomen. (After Ris.)
43. *Gynacantha basiguttata* Sélys, male, dorsal view of tip of abdomen. (After Ris.)
44. *Gynacantha bayadera* Sélys, male, lateral view of tip of abdomen.
45. *Gynacantha bayadera* Sélys, male, dorsal view of tip of abdomen.

PLATE 3

FIG. 46. *Mesogomphus balneorum* sp. nov., male, wings.
47. *Heliogomphus bakeri* Laidlaw, male, wings.
48. *Oligoæschna zambo* sp. nov., male, wings.
49. *Orogomphus splendidus* Sélys, male, portion of base of hind wing. (After Ris.)
50. *Orogomphus splendidus* Sélys, thorax pattern. (After Ris.)
51. *Ictinogomphus tenax* Sélys, thorax pattern.
52. *Macromidia samal* sp. nov., tarsal claw.
53. *Gomphidia kirschii* Sélys, thorax pattern.
54. *Heliogomphus bakeri* Laidlaw, thorax pattern.
55. *Mesogomphus balneorum* sp. nov., thorax pattern.
56. *Macromia gerstaeckeri* Krüger, wings.
57. *Macromidia samal* sp. nov., female, wings.
58. *Idiophya salva* sp. nov., female, wings.

PLATE 4

FIG. 59. *Agrionoptera bartola* sp. nov., wings.
60. *Agrionoptera quatuornotata* Brauer, wings.

FIG. 61. *Orchithemis pulcherrima* Brauer, wings.
62. *Diplacodes trivialis* Fabricius, wings.
63. *Nannophya pygmæa* Rambur, wings.
64. *Tetrathemis irregularis* Brauer, wings.
65. *Brachythemis contaminata* Fabricius, wings.
66. *Neurothemis palliata* Rambur, wings.

PLATE 5

FIG. 67. *Lyriothemis cleis* Brauer, wings.
68. *Lyriothemis latro* sp. nov., wings.
69. *Macrodiplax cora* Brauer, wings.
70. *Urothemis bisignata* Brauer, wings.
71. *Rhyothemis phyllis* Sulzer, wings.
72. *Crocothemis servilia* Drury, wings.

PLATE 6

FIG. 73. *Lathrecista asiatica* Fabricius, wings.
74. *Potamarcha obscura* Rambur, wings.
75. *Cratilla metallica* Brauer, wings.
76. *Orthetrum sabina* Drury, wings.
77. *Raphismia bispina* Hagen, wings.
78. *Trithemis aurora* Burmeister, wings.
79. *Trithemis pallidinervis* Kirby, wings.
80. *Brachydiplax chalybea* Brauer, wings.

PLATE 7

FIG. 81. *Zyxomma petiolatum* Rambur, wings.
82. *Hydrobasileus croceus* Brauer, wings.
83. *Zygonyx ida* Karsch, wings.
84. *Diplacina braueri* Sélys, thorax, pattern.
85. *Diplacina bolivari* Sélys, thorax pattern.
86. *Acisoma panorpoides* Rambur, wings.
87. *Diplacina braueri* Sélys, wings.
88. *Onychothemis abnormis* Brauer, wings.

PLATE 8

FIG. 89. *Tramea limbata* Desjardins, wings.
90. *Pantala flavescens* Fabricius, wings.
91. *Tholymis tillarga* Fabricius, wings.
92. *Camacinia gigantea* Brauer, wings.
93. *Idionyx* sp., nymph.
94. *Idionyx* sp., tip of lateral lobe of labium of nymph.
95. *Idionyx* sp., labium of nymph.

PLATE 9

FIG. 96. *Diplacodes trivialis* Fabricius, labium of nymph.
97. *Diplacodes trivialis* Fabricius, tip of lateral lobe of labium of nymph.
98. *Tetrathemis irregularis* Brauer, labium of nymph.
99. *Tetrathemis irregularis* Brauer, tip of lateral lobe of labium of nymph.

FIG. 100. *Tetrathemis irregularis* Brauer, nymph.
101. *Neurothemis* sp., nymph No. 1, labium.
102. *Neurothemis* sp., nymph No. 2, tip of lateral lobe of labium.
103. *Orthetrum* sp., nymph No. 3, labium.
104. *Orthetrum* sp., nymph No. 3, tip of lateral lobe of labium.
105. *Orthetrum* sp., nymph No. 1, tip of lateral lobe of labium.
106. *Orthetrum* sp., nymph No. 1, labium.
107. *Orthetrum* sp., nymph; *a*, lateral anal appendage; *b*, inferior anal appendage; *c*, superior anal appendage; *d*, dorsal hook; *e*, lateral spine.
108. *Orthetrum* sp., nymph No. 2, labium.
109. *Orthetrum* sp., nymph No. 2, tip of lateral lobe of labium.
110. *Macromia* sp., labium of nymph; *f*, median lobe; *g*, lateral lobe; *h*, mental setæ; *i*, lateral setæ.
111. *Macromia* sp., nymph.
112. *Macromia* sp., tip of lateral lobe of labium; *j*, movable hook; *k*, tooth.
113. *Diplacina braueri* Sélys, nymph. (Drawn by T. W. Lew.)
114. *Diplacina bolivari* Sélys, labium of nymph.
115. *Diplacina bolivari* Sélys, tip of lateral lobe of labium of nymph.
116. *Tholymis tillarga* Fabricius, tip of lateral lobe of labium of nymph.
117. *Tholymis tillarga* Fabricius, labium of nymph.
118. *Tholymis tillarga* Fabricius, nymph.

PLATE 10

FIG. 119. Near ? *Amphiæschna*, nymph.
120. Labium of nymph shown in fig. 119.
121. *Heliogomphus bakeri* Laidlaw, labium of nymph.
122. *Heliogomphus bakeri* Laidlaw, nymph.
123. *Gynacantha* sp., young nymph.
124. *Gynacantha* sp., labium of nymph.
125. *Mesogomphus balneorum* sp. nov., nymph very near transformation.
126. *Mesogomphus balneorum* sp. nov., labium of nymph.
127. *Tetracanthagyna bakeri* Campion, nymph.
128. *Tetracanthagyna bakeri* Campion, labium of nymph.
129. *Gomphidia kirschi* Sélys, labium.
130. *Gomphidia kirschi* Sélys, nymph.

TEXT FIGURES

FIG. 1. Diagrams of venational characters of anisopterous wings. *1*, Diagram of the principal veins and their connections; *2*, *Cordulegaster savi*, wings; *3*, gomphine wing base, male; *4*, libelluline wing base; *5*, arculus and its sectors (M_{1-3} M_3); *6*, *Cyanocharis valga*, forewing; *7*, *Caliphæa consimilis*, part of wing base; *8*, *Telebasis salva*, forewing; *9*, *Telebasis salva*, part of wing base; *10*, *Anomalagrion hastatum*, stigma, female with brace vein *x*.

ABBREVIATIONS

A, Anal vein; *Ac*, anal crossing; *Al*, or *al*, anal loop; *an*, antenodal crossveins; *ap pl*, apical planate; *ar*, arculus; *b*, basal subcostal crossvein; *br*, bridge; *Bs*, midbasal space, space before the arculus; *brs*, basal radial space; *C*, costa; *Cu*, cubitus; *g*, gaff (fused portion of veins Cu_2 and A_1); *h*, hypertriangular space; *M*, media; *m*, membranule, bordering the 3-celled anal triangle of the male hind wing; *ma*, medio-anal link; *mf*, middle fork; *mpl*, median planate; *mr*, midrib (bisector of the anal loop); *n*, nodus; *o*, oblique vein; *p*, patella; *q*, quadrangle; *R*, radius; *rm*, radial sector; *rpl*, radial planate; *s*, subtriangle; *Sc*, subcosta; *sct*, sectors of the arculus; *sn*, subnodus; *sq*, subquadrangle; *st*, stigma; *t*, triangle; *tr pl*, trigonal planate; *u*, point at which petiolation (stalk) of wing base ceases; *x*, brace vein to the stigma.

FIG. 2. *Heteronaias heterodoxa* Sélys; A, Tip of lateral lobe of labium of nymph; B, labium of nymph; C, nymph; D, lateral view of tip of abdomen of male; E, ventral view of tip of abdomen of female; F, wings.

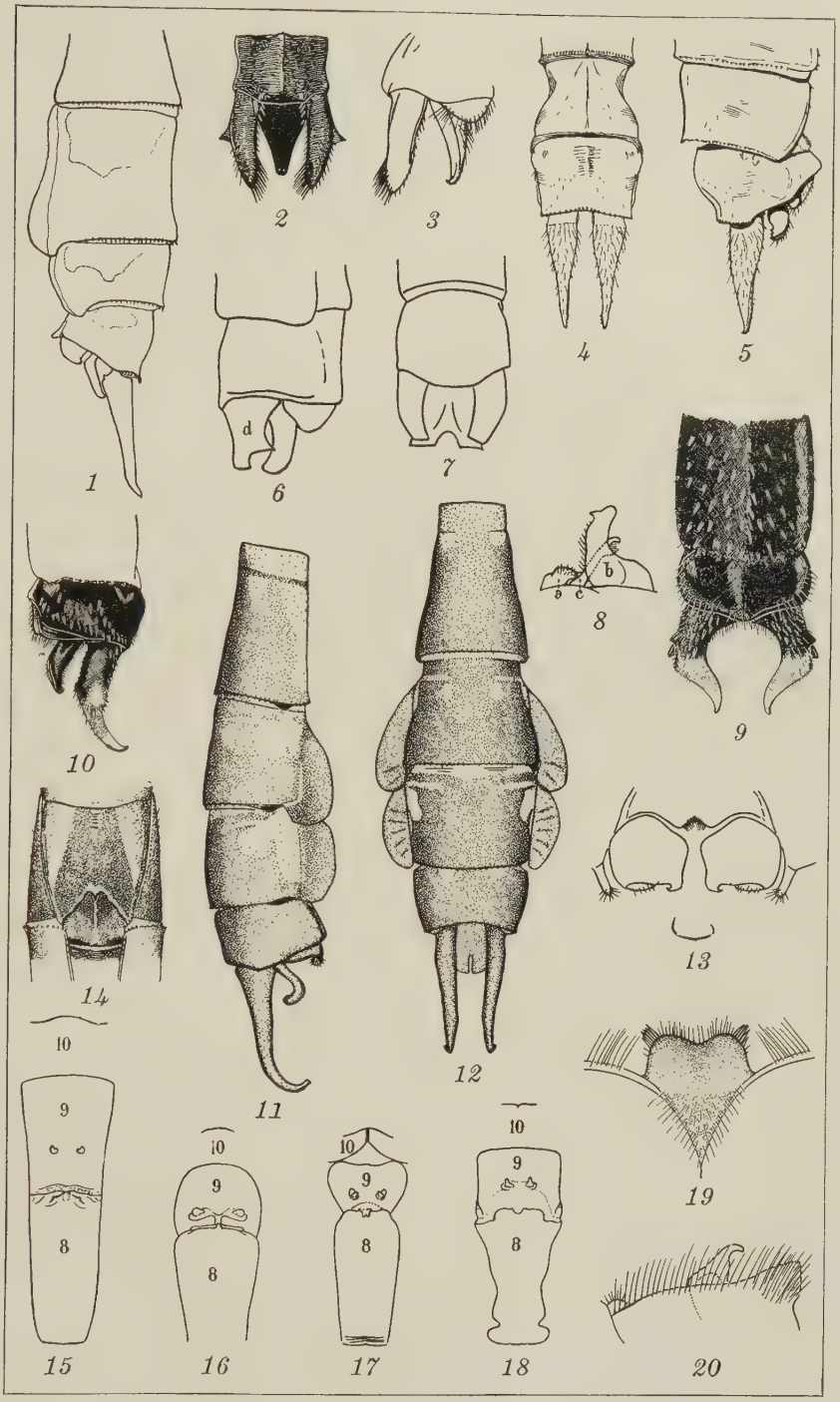
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PLATE 1.

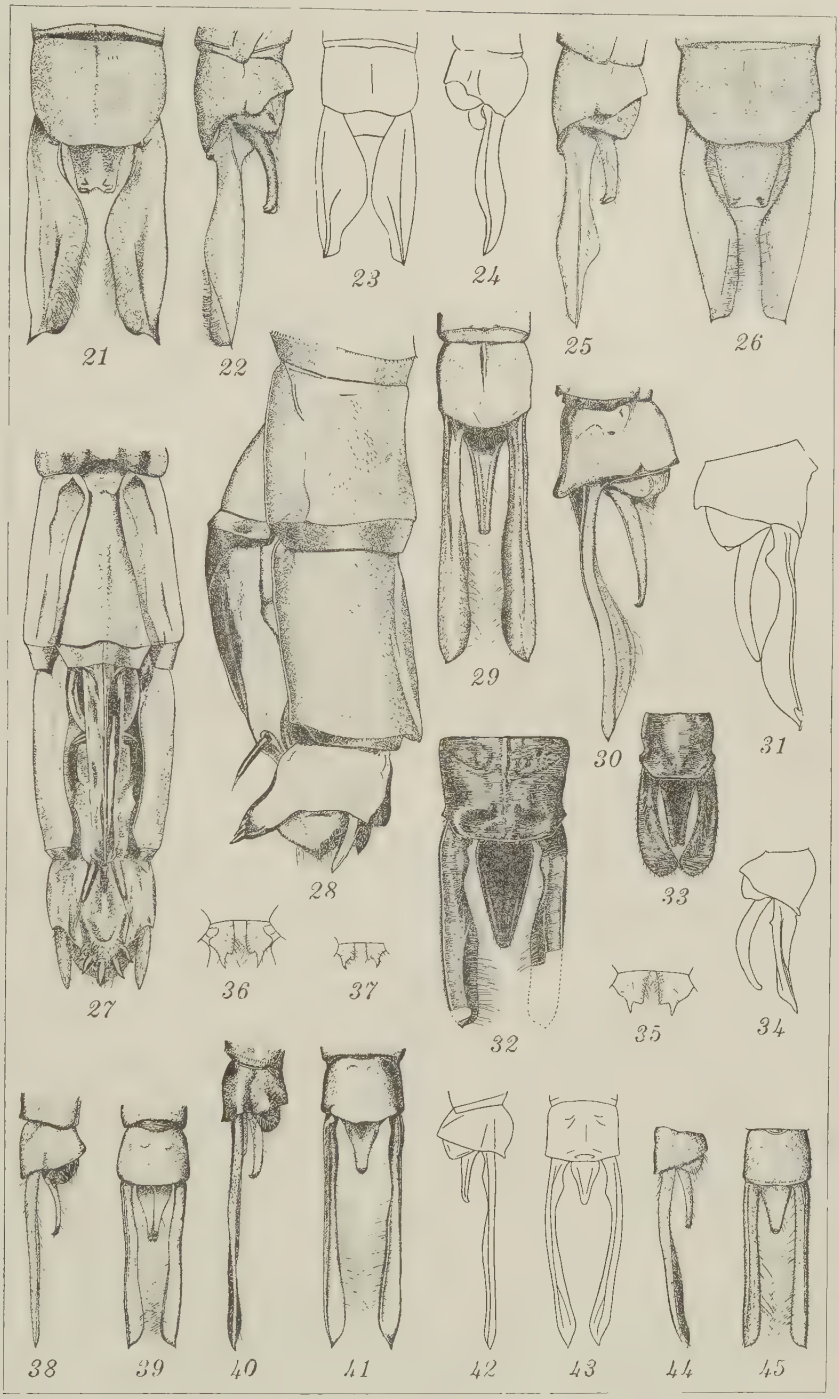
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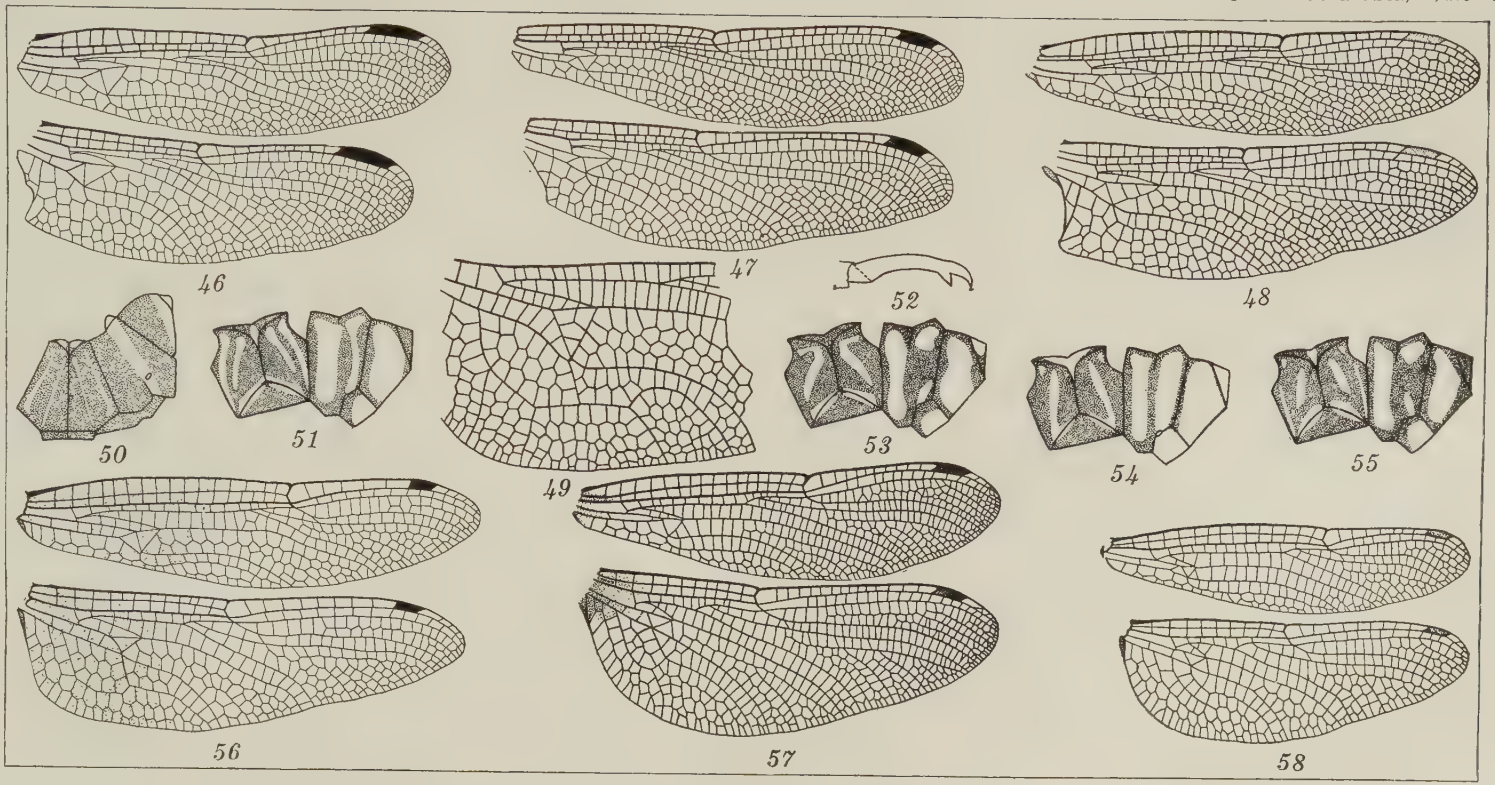
PLATE 2.



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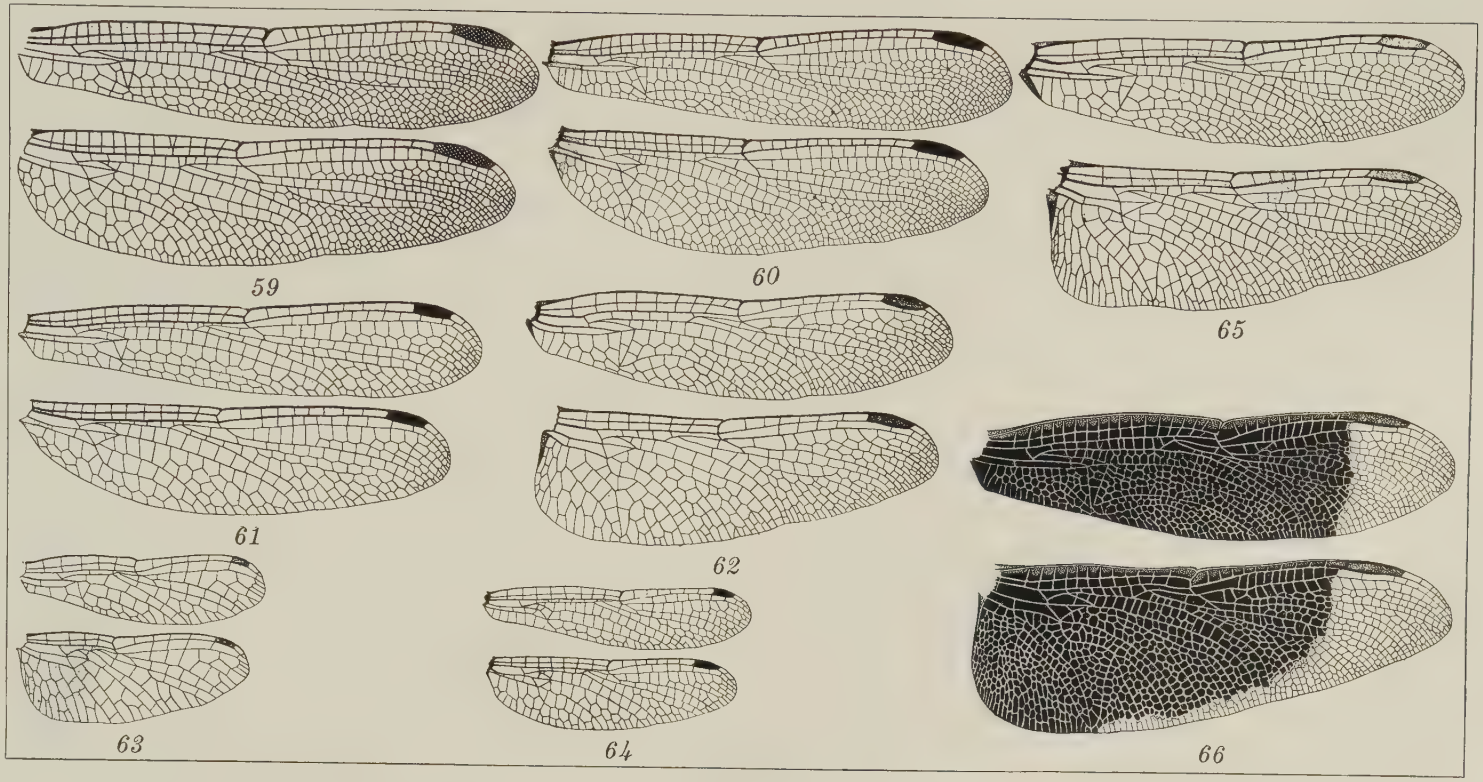

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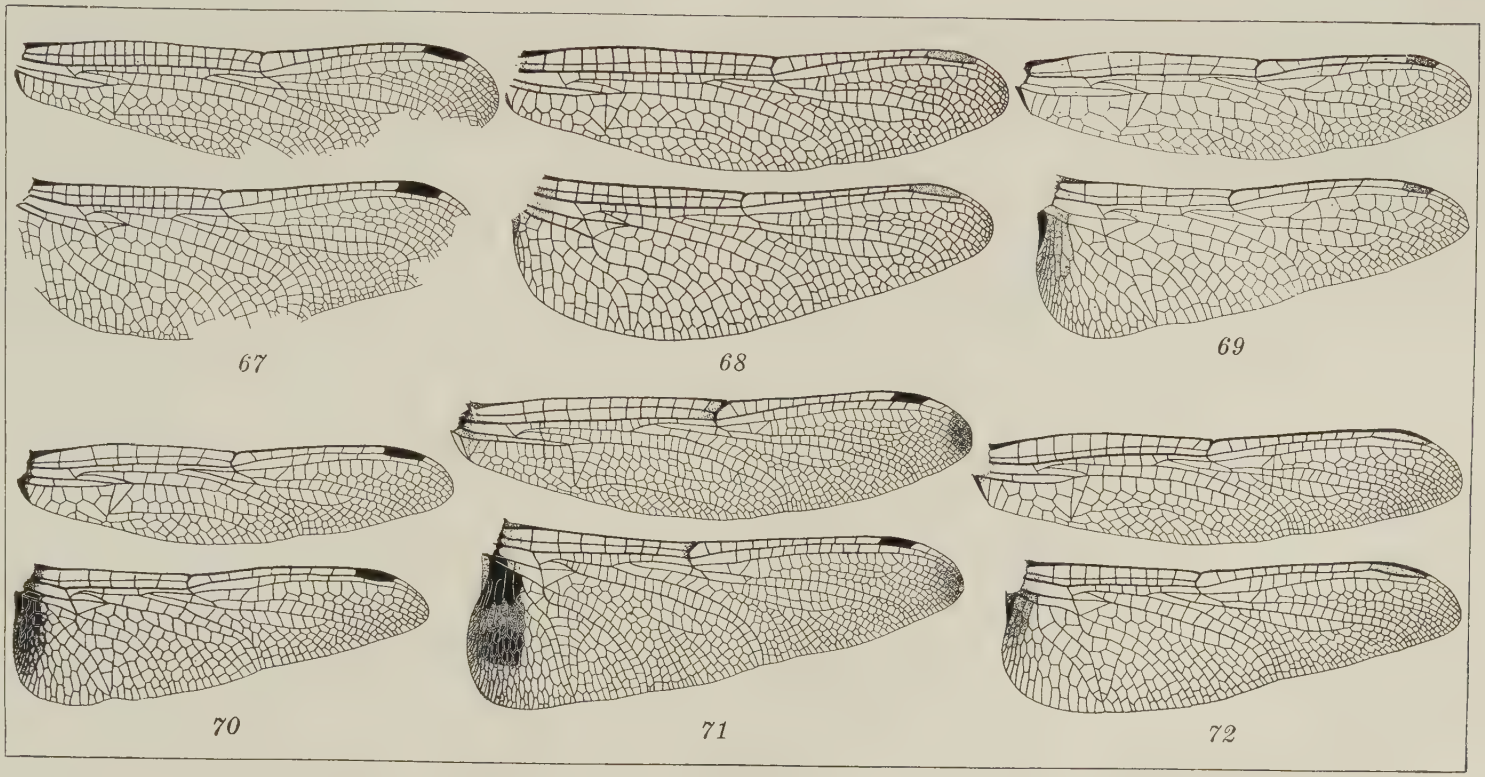

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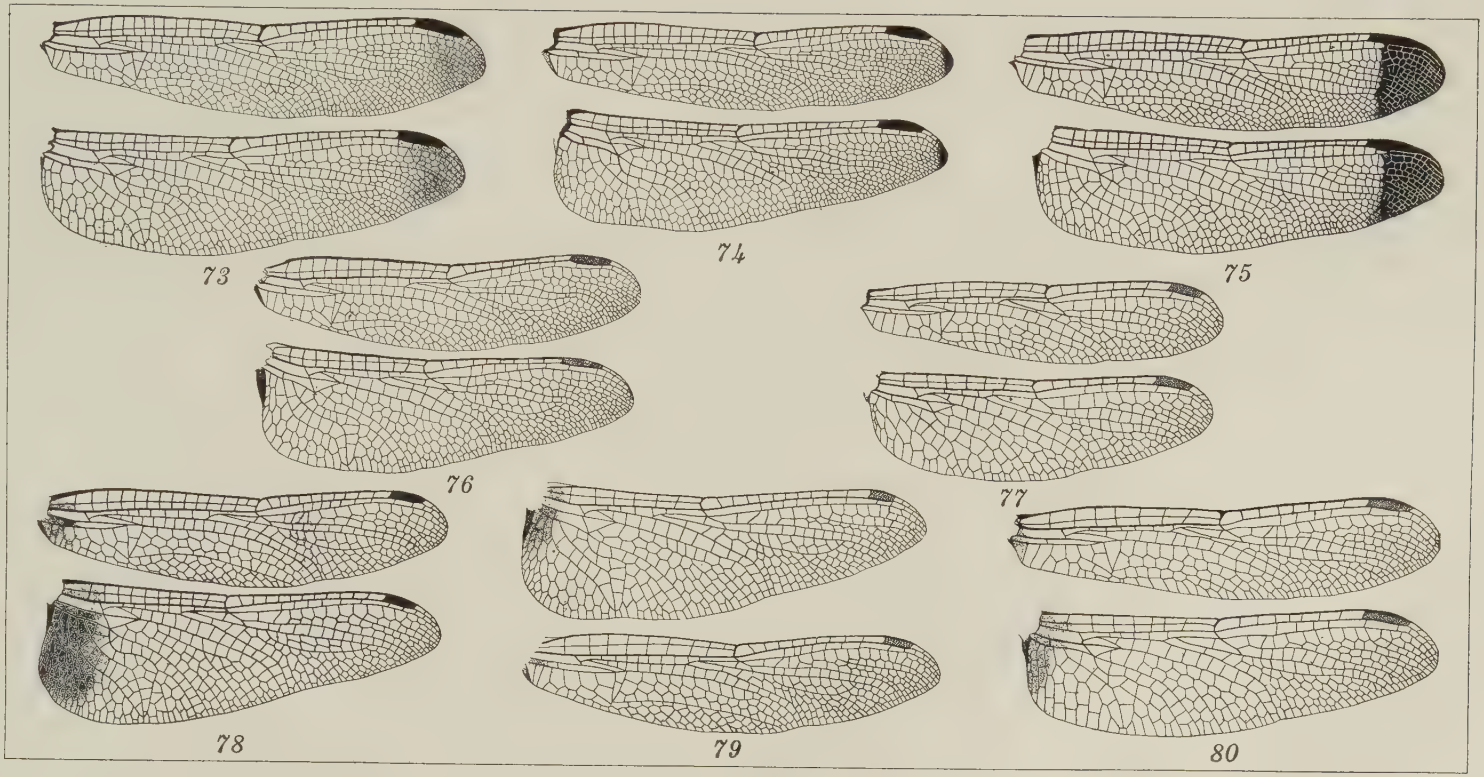
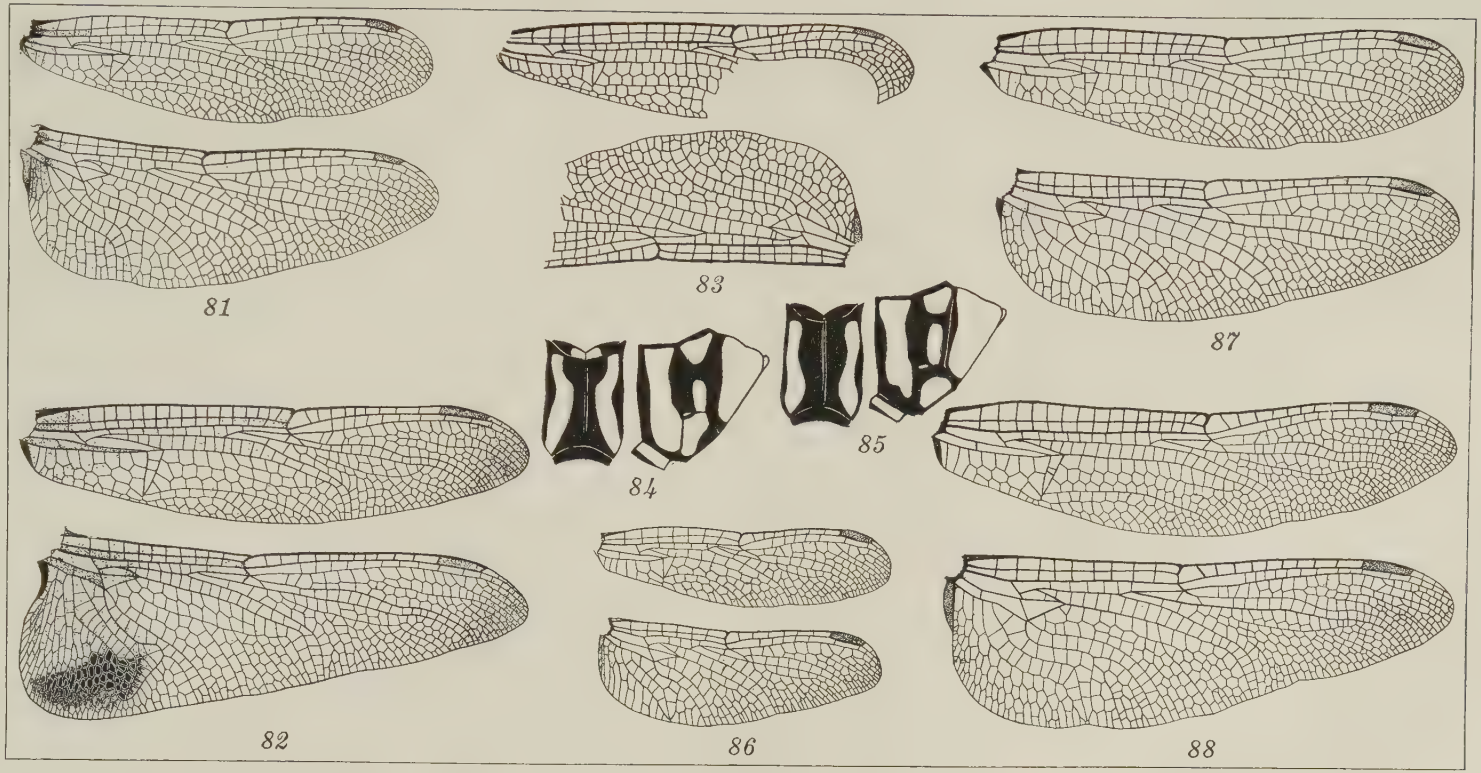


PLATE 6.



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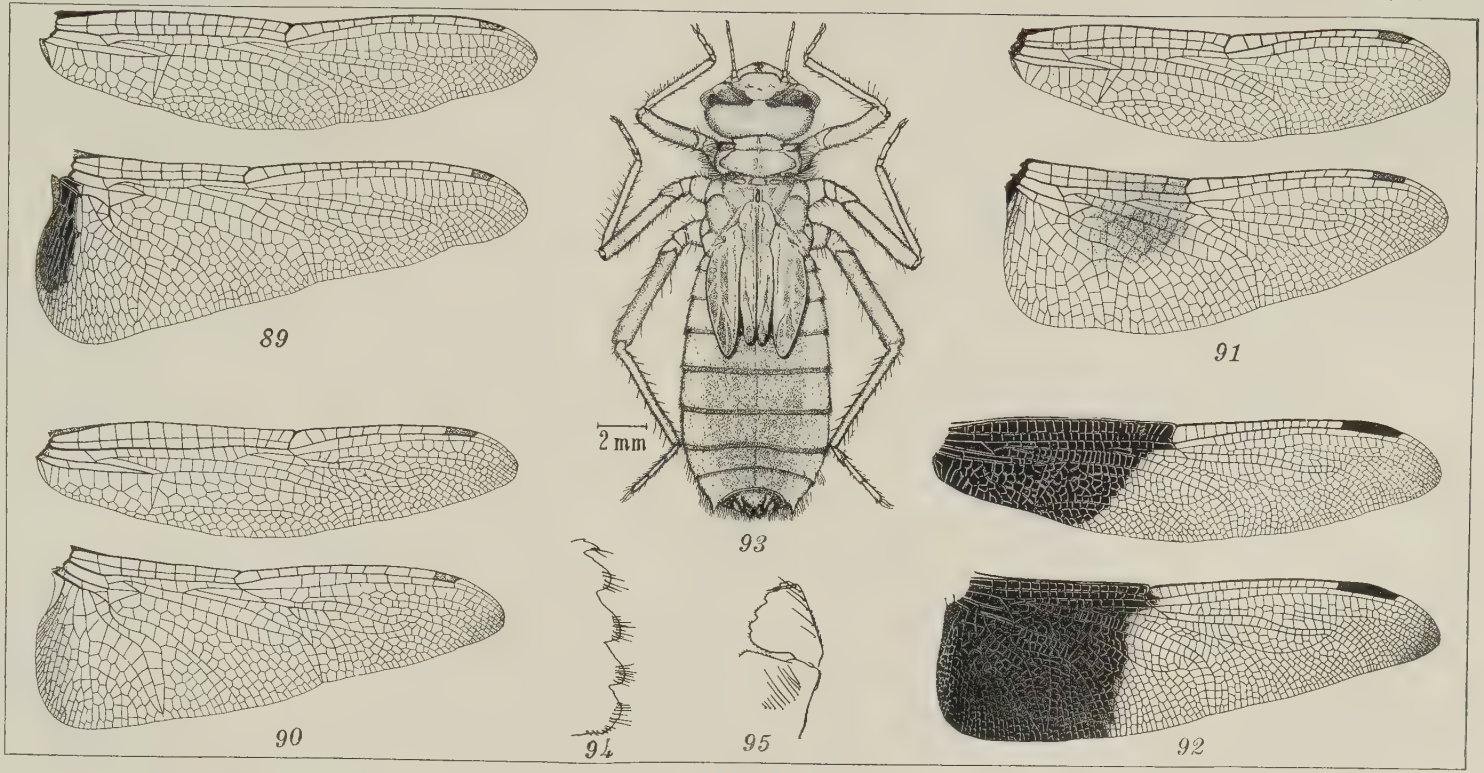

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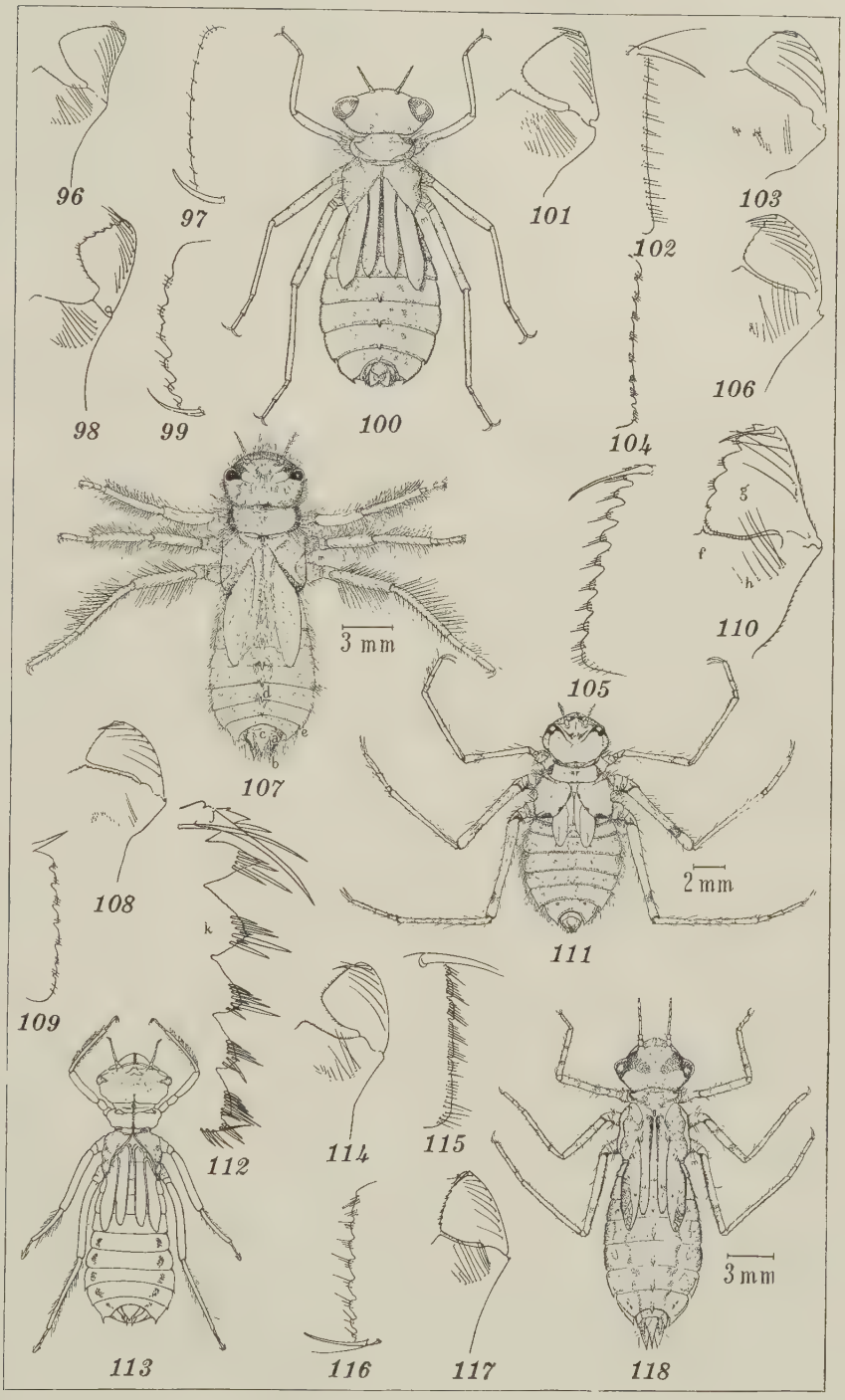
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PLATE 9.

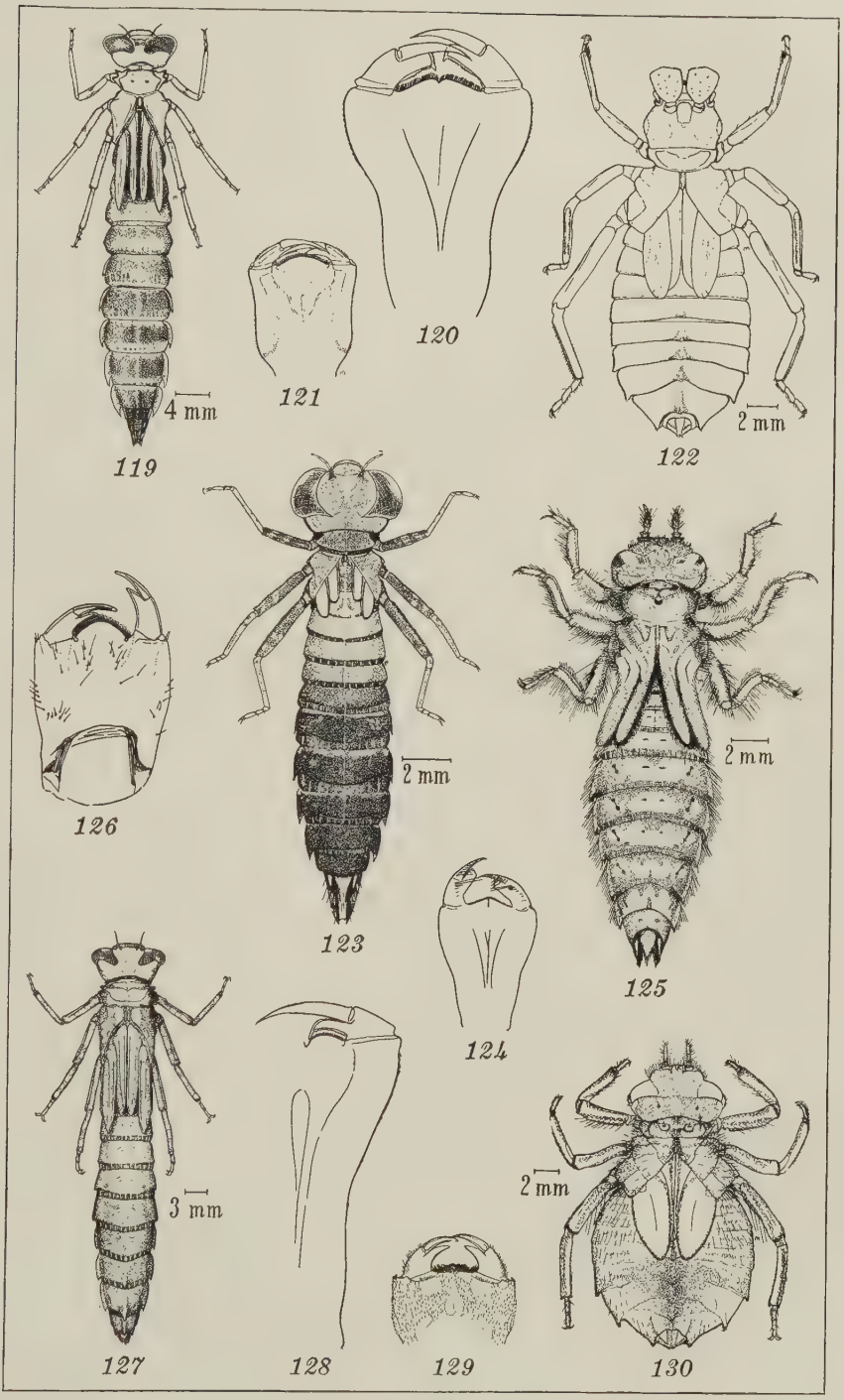
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PLATE 10.

ZWEI NEUE HISPINEN VON DEN PHILIPPINEN (COLEOPTERA)[1]

Von Erich Uhmann

Stollberg, Erzgebirge, Deutschland

ONCOCEPHALA PHILIPPINICA sp. nov.

In Beitrag 40,[2] Seite 64, habe ich bemerkt, dass *Oncocephala angulata* Gestro von den Philippinen in der Deckenskulptur von *angulata* aus Sumatra soweit abweicht, dass die philippinischen Stücke vielleicht einer neuen Art angehörten. Die Untersuchung einiges Materials aus Java von *angulata* bestätigte diese Annahme. Ihre Unterschiede gegen *angulata* sind in dem erwähnten Beitrag aufgeführt. Von *bicristata* Chapuis unterscheidet sie sich dadurch, dass die Erhabenheiten des 2. Raumes nicht so gleichmässig sind, sondern dass die 2. Erhabenheit nach hinten immer höher ansteigt, um dann ebenso allmählich abzufallen. Bei *acutangula* Gest. besteht diese Erhabenheit aus zwei Höckern, deren letzter spitzig ist; bei unserer Art sind beide zu einem verschmolzen. Hinterecke wie bei *bicristata*. *Oncocephala angulata* ist für die Philippinen zu streichen. 4 bis 4.5 mm.

Luzon, Laguna, 1 (Schultze Sammlung), Holotypus; Mount Maquiling, 1 (G. C. Ladrera, Sammlung Hadden), Paratypus: Tayabas, Malinao, 1 (Baker Sammlung), Paratypus. Im Schlüssel,[3] ist einzufügen:

3a. Die grosse Erhabenheit des 2. Raumes hinten steil abfallend. *angulata* Gestro.

3b. Diese allmählich abfallend..... *philippinica* Uhmann.

ANISODERA DENSE sp. nov.

A. humili Gestro simillima, sed prothorace dense punctato, medio latissimo. Tibiis anticis intus subrectis. 14 ad 15 mm.

Wie ich[4] bemerkte, unterscheiden sich die Stücke, die ich als *humilis* von den Philippinen ansprach, durch den Halsschild von

[1] 66. Beitrag zur Kenntnis der Hispinen (Coleoptera; Chrysomelidæ).

[2] Uhmann, Erich, Beitrag 40, Folia Zoologica et Hydrobiologica Riga 5 (1933) 56–77.

[3] Op. cit. 64, 65.

[4] Op. cit. 59, 60.

denen aus Sumatra. Halsschild der neuen Art in der Mitte am breitesten, bei *humilis* vorn; auf der Scheibe durchaus dicht und stark punktiert, bei *humilis* in der Mitte weitläufiger oder glatt, kaum länger als breit, vorm Schildchen kaum eingedrückt, bei drei Stück dort gewölbt. Körper gedrungener, weil die Decken gleich hinter den Schultern sich verbreitern. Nahtzahn nicht vorhanden, Nahtecke einfach. Vorderschienen vorn am Innnenrand fast gerade oder wenig geschwungen, bei *humilis* dort stark geschwungen-ausgerandet. Geschlechtsauszeichnung des Männchens [5] wie bei *humilis,* letztes Sternit hinten fast gerade abgeschnitten.

[5] Mindanao, Surigao, 4 Männchen (Baker Sammlung), Holotypus und Paratypen.

DIE HENICOPTERA-ARTEN DER PHILIPPINEN (DIPTERA)[1]

Von MARTIN HERING
Berlin, Deutschland

EINE TAFEL

Die durch das eigenartige Geäder leicht kenntliche Gattung der Fruchtfliegen war von den Philippinen bisher nur in einer Art (*Henicoptera proditrix* Osten Sacken) bekannt. Unter diesem Namen erhielt ich von der Firma Dr. O. Staudinger und A. Bang-Haas (Dresden) eine Anzahl Exemplare zugesandt, die untereinander in einigen Punkten verschieden waren und bei genauerer Untersuchung sich als vier verschiedene Arten erwiesen, von denen keine zu der Osten-Sackenschen Art zu stellen war, und die sich vielmehr sämtlich als neu erwiesen. Wie bei den Dacinen muss auch bei dieser Gattung die Zeichnung des Kopfes für die Art-Trennung herangezogen werden. Die Schwierigkeit liegt nun darin, dass diese Kopfzeichnungen bei den beiden Geschlechtern verschieden sind; wie es scheint, ist aber die Thoraxzeichnung bein Männchen und Weibchen gleich, so dass deren Merkmale zur Unterstützung herangezogen werden können. Nur bei einer Art liegen mir auch die Weibchen vor, für die anderen kann vorerst nur die Beschreibung des Männchens gegeben werden; ich hoffe, dass es an Hand der gegebenen Differenzierung auch bald möglich sein wird, die zugehörigen Weibchen aufzufinden.

Bestimmungstabelle der Männchen der philippinischen Henicoptera.

1. Neben den Fühlerwurzeln liegt auf dem Stirnaugenrande je ein schwärzlicher Fleck. Der schwarze Mittelstreifen des Throax isoliert, nicht mit den beiden seitlichen verbunden (Tafel 1, Fig. 2*b* bis 4*b*) ..... 2.

Ein schwarzer Fleck neben den Fühlerwurzeln (wie auch auf dem Untergesicht) fehlt. Der schwarze Mittelstreifen auf dem Thoraxrücken ist am Ende desselben mit den beiden seitlichen verbunden (Tafel 1, Fig. 1). Vorder- und Mittelschenkel einfarbig gelb. Das 2. Segment des Abdomens am Hinterende dunkel gefleckt, im Flügel der Raum zwischen C und R_{4+5} überall braun ausgefüllt.

spoliata sp. nov.

[1] 8. Beitrag zur Kenntnis der Trypetidæ.

2. Am Abdomen das (1.+)2. Segment mit dunklem Querband, das die beiden seitlichen Streifen verbindet ..... 3.
   Das 2. Segment des Abdomens ohne dunkles Querband, die beiden Längsstreifen an den Seiten des Abdomens nirgends vereinigt..... 4.
3. Untergesicht mit dunklem Fleck. Vorder- und Mittelschenkel vor dem Ende hinten mit braunem Fleck. Die braune Binde im Flügel über den ta erreicht in der Analzelle das Braun der Flügelwurzel.
   proditrix O. S.
   Untergesicht einfarbig gelb. Vorder- und Mittelschenkel gelb, die mittleren unten mit einem fadendünnen braunen Längsstrich vor dem Ende. Das Braun der Wurzel des Flügels bleibt von dem der Binde über den ta weit getrennt, da diese Binde nur bis zum Ende der Can reicht ..... *interrupta* sp. nov.
4. Der dunkle Mittelstreifen des Thorax ist überall gleichmässig schmal (Tafel 1, Fig. 3*b*). Der schwarze Endfleck des Scutellums ist breiter als lang und erreicht nicht die vorderen zwei Drittel der Schildchenlänge. Der helle Raum in der Cb_1 des Flügels setzt sich kurz vor dem ta in die Csm fort. Alle Schenkel und das Untergesicht einfarbig gelb ..... *flavofemoralis* sp. nov.
   Mittelstreifen des Thorax gegen das Ende breit keilförmig erweitert. Der dunkle Endfleck des Scutellums wenigstens so lang wie breit, die Hälfte bis zwei Drittel der Schildchenlänge erreichend (Tafel 1, Fig. 4*b*). Der helle Raum in der Cb_1 setzt sich vorderrandwärts nicht nur in die Csm, sondern auch in die Cm fort. Hinterschenkel gebräunt, Untergesicht mit schwarzer, senkrechter Mittelstrieme.
   cuneilinea sp. nov.

BESCHREIBUNG DER ARTEN

HENICOPTERA SPOLIATA sp. nov. Tafel 1, Fig. 1a und 1b.

Kopf gelb, das Endglied der Fühler verdunkelt, die Stirn mit einer undeutlichen dunkleren Mittellinie vor den Ocellen, die sich bis zur Lunula mehr oder weniger deutlich hinzieht. Thoraxrücken gelbbraun, mit den drei Längsstreifen, die auch *H. proditrix* Osten Sacken besitzt, aber der mittlere erweitert sich allmählich wenig nach hinten und ist am Ende mit den beiden seitlichen breit verbunden. Die beiden seitlichen an der Quernaht breit unterbrochen. Der schwarze Humeralfleck ist rundlich, das Nahtdreieck ganz schwarzbraun. Der schwarze Endfleck des Scutellums ist viel breiter als lang; er erreicht etwa das letzte Drittel des Schildchens. Abdomen gelbbraun, mit den beiden gewöhnlichen Seitenstriemen, die in der hinteren Hälfte des (1. +) 2. Segmentes durch ein breites schwarzbraunes Querband miteinander verbunden sind. Schenkel ganz gelb, die hinteren vorherrschend schwarzbraun. Im Vorderflügel der Raum zwischen C und R_{4+5} ganz braun, das dunkle Querband über den ta von der m angegabelt, der äussere Ast geht über tp zur Cp_3, der innere zum Ende der an, die Can nicht erreichend.

Der Analzellenzipfel ist grösstenteils hyalin. Grösse wie bei *H. proditrix* Osten Sacken.

MINDANAO, Port Banga, Männchen, Typus, 6. 1. 1915.

HENICOPTERA INTERRUPTA sp. nov. Tafel 1, Fig. 2a und 2b.

Die Art gleicht in der Grösse und in den meisten Merkmalen der vorigen, unterscheidet sich aber leicht dadurch, dass die Stirnaugenränder neben den Fühlerwurzeln je einen schwärzlichen Fleck tragen (der dem Weibchen wahrscheinlich fehlen wird). Untergesicht ebenfalls rein gelb. Von den Thoraxstreifen ist der mittlere gleichmässig schmal und wird gegen das Ende des Thoraxrückens ganz undeutlich. Der schwarze Humeralfleck ist länglich, streifenartig. Der Endfleck des Scutellums ist viel schmäler; er überschreitet an den Seiten die Wurzeln der hinteren Schildchenborsten kaum. Beine und Hinterleib wie bei der vorigen Art gezeichnet. Das Nahtdreieck ist kaum verdunkelt. Im Flügel sind die beiden Querbinden über tp und die Discoidalzelle viel breiter, die erstere am Hinterrande des Flügels auch breiter ausgeflossen, die letztere das Ende des Zipfels der Can erreichend, beide durch Gelb oder Braun bis etwas hinter die cu verbunden. Die Binde über den tp ist an der Distalseite nicht gebogen, sondern geht grade zum Hinterrande des Cp_2. Zipfel der Analzelle in den äusseren zwei Dritteln hyalin. Cp_3 an der Wurzel braungelb ausgefüllt.

MINDANAO, Surigao, Männchen, Typus, August, 1916.

HENICOPTERA FLAVOFEMORALIS sp. nov. Tafel 1, Fig. 3a und 3b.

Kopf wie bei den vorigen, der Mittelstreifen auf der Stirnstrieme undeutlicher, deutlich ein rundlicher Fleck über der Lunula. Der dunkle Fleck neben der Fühlerbasis vorhanden, Untergesicht ganz gelb. Auf dem Thoraxrücken die schwarze Mittelstrieme ausserst fein, gleichbreit, am Ende nicht verkürzt. Der schwarze Endfleck des Scutellums viel breiter als lang, nach vorn hin nicht ein Drittel des Schildchens einnehmend. Abdomen mit den beiden seitlichen schwarzen Linien, die vorn auf dem 2. Segment nicht verbunden sind. Beine ganz gelb, auch die Hinterschenkel. Flügel im Vorderrandsteil braun wie bei den vorigen Arten, aber der hyaline Raum in der Cb_1 dringt nach vorn in die Csm ein und erreicht r_{2+3}. Binden wie bei der vorigen Art, die über tp aber schmäler und etwas gebogen, die proximale hakig an cu gebogen und zur Mündung der an gehend, die Can nicht erreichend. Analzellenzipfel ganz gelb, wie auch die Wurzel der Cp_3. Grösse wie bei den vorigen Arten.

LUZON, Limay, Männchen, Typus, 21. Oktober, 1914 (von G. Boettcher gesammelt).

HENICOPTERA CUNEILINEATA sp. nov. Tafel 1, Fig. 4a und 4b.

Männchen.—Kopf wie bei den vorigen Arten, Verdunkelung auf der Stirnmitte undeutlich. Der schwarze Fleck neben den Fühlerwurzeln ist vorhanden. Untergesicht mit einer schwarzen, senkrechten Längslinie. Thoräxrücken mit den drei schwarzen Längslinien, die mittlere hinter der Querlinie der vordersten sa ziemlich plötzlich breit keilförmig erweitert und so verbreitert bis zum Ende des Thoraxrückens verlaufend, dort aber nicht mit den seitlichen Linien verbunden. Nahtdreieck ganz gelb, der schwarze Humeralfleck rundlich. Der Endfleck des Scutellums mindestens so lang wie breit, bis zur Mitte des Schildchens oder noch weiter nach vorn reichend. Schenkel gelb, die hinteren braun. Seitenstreifen des Abdomens vorn nicht verbunden. Flügelzeichnung ähnlich wie bei voriger Art, die Cb_1 erstreckt ihr hyalines Feld aber bis in die Cm hinein und endet erst an r_1.

Weibchen.—Die schwarzen Seitenflecken neben den Fühlerwurzeln fehlen, der senkrechte schwarze Strich auf der Untergesichtsmitte ist vorhanden, im Flügel sind die beiden Querbinden in der Discoidalzelle durch ein hyalines Feld getrennt, dort beim Männchen durch Gelb verbunden.

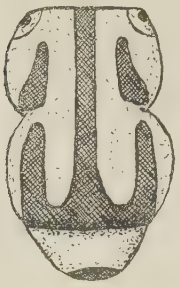
LUZON, Manila, Männchen, Holotypus; Weibchen, Allotypus; und 3 Paratypen, 1. Juni, 1914.

ILLUSTRATION

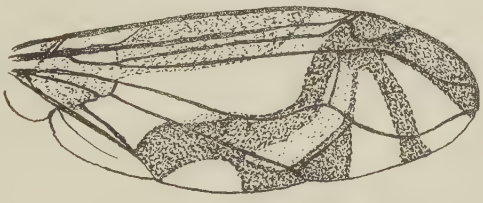
TAFEL 1

FIG. 1. *Henicoptera spoliata* Hering sp. nov.; *a*, Flügel; *b*, Thorax.
2. *Henicoptera interrupta* Hering sp. nov.; *a*, Flügel; *b*, Thorax.
3. *Henicoptera flavofemoralis* Hering sp. nov.; *a*. Flügel; *b*, Thorax.
4. *Henicoptera cuneilineata* Hering sp. nov.; *a*, Flügel; *b*, Thorax.

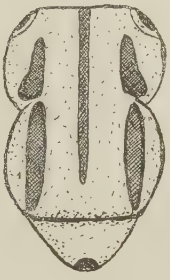
1a



1b

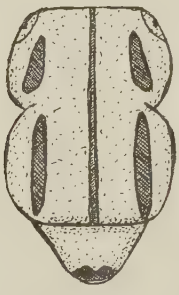


2a

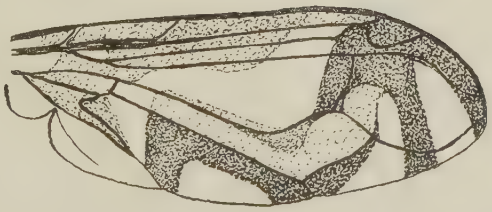


2b

3a



3b



4a

4b

PLATE 1.

BOOKS

Acknowledgment of all books received by the Philippine Journal of Science will be made in this column, from which a selection will be made for review.

RECEIVED

American society for testing materials. Committee D–2 on petroleum products and lubricants. Standards on petroleum products and lubricants. Philadelphia, The Society, 1936. 372 pp., illus., tables, diagrs. Price, paper, $2.

American society for testing materials. Committee D–13 on textile materials. Standards on textile materials. Philadelphia, The Society, 1936. 295 pp., illus., tables, diagrs. Price, paper, $2.

American society for testing materials. Pittsburgh regional meeting. Symposium on high-strength construction metals. Philadelphia, The Society, 1936. 126 pp., illus., tables, diagrs. Price, paper, $1.25.

Association of scientific workers. Industrial research laboratories; a list. (Halley Stewart trust publications, 3) London, George Allen & Unwin, ltd., 1936. 46 pp. Price, 3s.6d.

Bahr, Gunnar von. Studies on the aetiology and pathogenesis of Cataracat zonularis; an academic treatise. Upsala, Almquist & Wiksells, 1936. 236 pp., plates, diagrs.

Bigelow, M. A. Sex-education. Rev. ed. New York, The American social hygiene association, 1936. 307 pp. Price, $1.

British association for the advancement of science. Mathematical tables, v. 5. London, The Association, 1935. 291 pp., tables. Price, 20s.

British museum (Natural history). The student's index to the collection of minerals. 27th. ed. London, The Museum, 1936. 39 pp. Price, paper, 1s.

Carver, A. E., Thomas Hunt, and William Willcox. Alcoholism in general practice. London, Constable & Co., ltd., 1936. 131 pp. Price, 7s.6d.

Chase, Carl Trueblood. Frontiers of science. New York, D. Van Nostrand co., 1936. 352 pp., front., plates. Price, $3.75.

Cook, E. F., and LaWall, C. H. Remington's practice of pharmacy; a treatise on the making, standardizing, and dispensing, of official, unofficial, and extemporaneous pharmaceutical preparations, with descriptions of medicinal substances, their properties, uses, and doses, and such other professional service in connection with community health as the pharmacist may be called upon to render. 8th ed. Philadelphia, J. B. Lippincott co., 1936. 2162 pp., illus. Price, $10.

Dawkins, C. J. M. On the incidence of anaesthetic complications and their relation to basal narcosis. London, published for the Middlesex hospital press by John Murray, 1936. 56 pp., tables. Price, 3s.6d.

Dyson, J. Newton. The practice of ionization. London, H. Kimpton, 1936. 178 pp., illus. Price, 6s.

EDWARD LIVINGSTON. Trudeau; a symposium. New York, The Livingston press, 1935. 112 pp., plates. Price, $1.10.

IMMS, A. D. On a new species of Halobates, a genus of pelagic Hemiptera. British museum (Natural history) John Murray expedition, 1933–34. Scientific reports, v. 4, no. 2. London, The Museum, 1936. 8 pp., illus. Price, paper, 1s.

The Institution of petroleum technologists, London. Petroleum technology, 1935. London, The Institution, 1936. 263 pp., tables, plates, diagrs. 7s.6d.

KANE, SAMUEL E. Thirty years with the Philippine head-hunters. New York, Grosset & Dunlap, 1936. 331 pp., illus. Price, $1.

KEMP, TAGE. Prostitution; an investigation of its causes, especially with regard to hereditary factors. Copenhagen, Levin & Munksgaard, 1936. 253 pp., tables, diagrs. Price, 10 kr.

KUBIE, LAWRENCE S. Practical aspects of psychoanalysis; a handbook for prospective patients and their advisors. New York, W. W. Norton & co., 1936. 207 pp. Price, $2.

London. International co-operative congress. British co-operation today; issued by the British co-operative union in celebration of the 14th International co-operative congress, London, September, 1934. Manchester, Co-operative printing society, ltd., 1934. 207 pp., illus., tables, ports. Price, 2s.6d.

London county council. Measles; report of the medical officer of health and school medical officer on the measles epidemic, 1933–34. London, County council, 1936. 62 pp., fold. tables, diagrs. Price, paper, 1s.

MCKAY, W. J. STEWART. Appendicitis; when and how to operate, a guide for the general practitioner. Australia, Angus & Robertson, ltd., 1936. 260 pp., illus. Price, 12s.6d.

Massachussetts institute of technology. Color measurement laboratory. Handbook of colorimetry, prepared under the direction of Arthur C. Hardy. Cambridge, Mass., The Institute, 1936. 87 pp., tables, diagrs. Price, $5.

MULLER, H. J. Out of the night; a biologist's view of the future. New York, The Vanguard press, 1935. 127 pp. Price, $1.50.

NEVEU-LEMAIRE, M. Traite d'helminthologie medicale et veterinaire. Paris, Vigot Freres, Editeurs, 1936. 1514 pp., illus. Price, 175 fr.

PATON, JAMES. Report on the Meteorological observations. British museum (Natural history) John Murray expedition, 1933–34. Scientific reports, v. 2, no. 1. London, The Museum, 1936. 14 pp. Price, paper, 2s.

SEARS, PAUL B. Deserts on the march. Norman, University of Oklahoma press, 1935. 231 pp. Price, $2.50.

Socialist medical association. Gas attacks; is there any protection? London, Lawrence & Wishart, 1936. 32 pp., tables. Price, paper, 6d.

SÖDERMAN, HARRY, and JOHN J. O'CONNELL. Modern criminal investigation. New York, Funk & Wagnalls co., 1936. 461 pp., illus. Price, $3.

STUBBINGS, H. G. Cirripedia. British museum (Natural history) John Murray expedition, 1933–34. Scientific reports, v. 4, no. 1. London, The Museum, 1936. 70 pp., illus., map. Price, paper, 5s.

TATTERSALL, W. M. Mysidacea and Euphausiacea. British museum (Natural history) Great Barrier Reef expedition, 1928–29. Scientific reports, v. 5, no. 4. London, The Museum, 1936. 34 pp., text-figs. Price, 2s.6d.

TATTERSALL, W. M. The Zoöplankton: V. The occurrence and seasonal distribution of the Mysidacea and Euphausiacea. British museum (Natural history) Great Barrier Reef expedition, 1928–29. Scientific reports, v. 2, no. 8. London, The Museum, 1936. 13 pp., text-figs. Price, paper, 2s.

TROISIER, JEAN. Etudes experimentales recentes sur les maladies infectieuses. Paris, Masson et cie, 1935. 277 pp. illus., tables, diagrs. Price, paper, 45 fr.

UDALL, D. H. The practice of veterinary medicine. 2d ed. Ithaca, New York, The Author, 1936. 273 pp., illus., tables. Price, $5.

WEIR, WILBERT WALTER. Soil science; its principles and practice, including basic processes for managing soils and improving their fertility. Chicago, J. B. Lippincott co., 1936. 615 pp., illus., tables, diagrs., maps. Price, $3.50.

REVIEWS

Alcyonaria (Stolonifera, Alcyonacea, Telestacea, and Gorgonacea). By L. M. I. Macfayden. British Museum (Natural History) Great Barrier Reef Expedition, 1928–29. Scientific reports, Vol. 5, No. 2. The Museum, London, 1936. 71 pp., plates, text figs. Price, 5s.

This monograph on the Alcyonaria of the Great Barrier Reef of Australia is a continuation of the work of Prof. S. J. Hickson. The paper describes fifty-one species, of which six are new. This work on the soft corals is accompanied by very good camera-lucida drawings of spicules of a number of forms described, and by excellent photographs of alcyonarian colonies in their natural habitat, taken by Doctor Banton. This work, if taken in connection with the publications of Light and Roxas on Philippine Alcyonaria, will familiarize the student with the extent of this group of animals in Philippine waters.—H. A. R.

American society for testing materials. Proceedings of the Thirty-eighth Annual Meeting, Held at Detroit, Michigan, June 24–28, 1935. The Society, Philadelphia, 1936. Part I, 1488, pp.; Part II, 469 pp., illus. Price, $5.50 each.

The 1935 American Society for Testing Materials Proceedings are published in two parts; part I comprising committee reports and the new and revised A. S. T. M. tentative standards, and part II containing all technical papers, including the Marburg Lecture, "Aircraft: Materials and Testing."

Part I is the report of forty standing committees, covering one hundred thirty-six tentative specifications for ferrous and

nonferrous metals, cement, bricks, refractories, protective coatings, petroleum products, rubber, textile, and other materials.

Part II includes thirty-seven technical paper presented at the 1935 annual meeting, together with oral and written discussions.

—F. D. R.

American society for testing materials. Standards on petroleum products and lubricants. Prepared by Committee D–2 on petroleum products and lubricants. The Society, Philadelphia, 1936. 372 pp., illus., tables, diagrs. Price, $2.

The 1936 compilation of the American Society for Testing Materials Standards on Petroleum Products and Lubricants prepared by Committee D–2 is an important manual and valuable guide to chemists and all those interested in these subjects. The publication gives in a concise form the details of all the important methods involved in the analyses of petroleum products and lubricants. The definitions of terms related to these materials will prove very helpful in fostering the use of standard terms in petroleum nomenclature.—T. D. J.

American society for testing materials. Standards on Textile Materials. Prepared by Committee D–13 on textile materials. The Society, Philadelphia, 1936. 295 pp., illus., tables, diagrs. Price, $2.

The 1936 edition contains, besides all American Society for Testing Materials standards on textiles, new methods of testing: pile floor covering, fineness of wool, corded cotton gray goods, yarn slippage in silk, rayon and silk-rayon woven broad goods, and fastness to laundering or domestic washing of dyed or printed cotton fabrics and printed silk or rayon fabrics.

In addition, there are included, a proposed potassium dichromate oxidation method for the determination of total iron in asbestos textiles, a psychrometric table for relative humidity which combines both accuracy and convenience to an exceptional degree, a section comprising many excellent photomicrographs of common textile fibers, and a convenient yarn under conversion table. Also included are proposed methods covering the testing of wool felt and correction of breaking strength to standard regain.

During 1935–1936 changes have been made in standards covering wooden and worsted yarns, definitions and terms, silk and cotton tapes, and tests for small amounts of copper and manganese in textiles; also, cotton yarns, cotton sewing threads, asbestos tape, cotton tape, light and medium cotton fabrics, hose and belt ducks, and methods of testing woven fabrics.—F. D. R.

American society for testing materials. Symposium on High-Strength Constructional Metals. The Society, Philadelphia, 1936. 126 pp., tables, figs. Price, $1.25.

This symposium comprises five extensive technical papers and discussions presented at the 1936 American Society for Testing Materials regional meeting. The papers cover the chemical and physical and manufacturing and fabricating properties of metals and alloys applied for various constructional applications, including buildings, ships, automobile bodies, airplane wings, tanks, and others.

The papers give the latest information and data on carbon and low-alloy steels, corrosion-resisting steels, alloys of copper, alloys of nickel, and alloys of aluminum and magnesium. There are a great many charts and tables of data in the symposium, presenting much of the valuable and extensive information in condensed form.—F. D. R.

American society for testing materials. Symposium on Industrial Fuels. The Society, Philadelphia, 1936. 70 pp., tables, figs., map. Price, $0.75.

The Symposium on Industrial Fuels recently published by the American Society for Testing Materials comprises four extensive technical papers: Coal and Coke, Industrial Fuel Oils, Manufactured gas, and Liquefied Petroleum gas. The subjects covered by the writers are: Historical background, magnitude of the industry, future availability of raw materials, possibility of new processes, tests applied to the materials, significance of tests, utilization of materials, general aspects of the product, and utilization.—F. D. R.

Edward Livingston Trudeau; A Symposium. The Livingston press, New York, 1935. 112 pp., plates. Price, $1.10.

This book consists of four essays; Trudeau's Family Tree, by Lawrason Brown; Trudeau, the Physician, by Allen K. Krause; Trudeau, the Sportsman, by Charles C. Trembley; Trudeau, the Churchman, by Harry A. Pattison.

This group of essays presents various interesting phases of the life and character of Dr. Edward Livingston Trudeau, who was considered one of the outstanding pioneers in the field of sanatorium treatment for tuberculous patients in the United States. The main purpose of this volume is to honor the famous physician and to show the characteristic features of his career and personality.

The first essay traces Trudeau's family tree and shows his distinguished ancestry. Descending from physicians on both

sides of the family, he was probably influenced to a great extent by the family tradition in choosing the study of medicine as a life career. Many of Trudeau's ancestors occupied high positions in both the French and English colonial governments.

The second essay describes Trudeau's career as a physician. In his struggle against tuberculosis, a disease from which he himself suffered, Trudeau continually searched for a definite method or line of attack in fighting this dreadful disease.

The third essay vividly described Trudeau's intensive fondness for various kinds of sports, especially shooting. In the search for good hunting places, he was able to visualize a colony of pioneer invalids in the present site of the sanatorium which he founded. His love for sports was so keen that he indulged in them even when he was laid up by the ravages of tuberculosis.

The last essay is devoted to the personality of Doctor Trudeau, particularly giving an insight into the nobility of his character. It shows his deep and abiding faith in God as the Creator of the Universe and in His imminent presence among men. Trudeau's influence on his patients was said to be largely spiritual. He was neither a genius nor a saint, but he was a man of God, ever giving of himself to his friends and patients.

This little book is especially recommended to those readers who are interested in the humanitarian aspects of the struggle which this great pioneer has waged against the ravages of tuberculosis. Undoubtedly this volume, consisting of a group of essays by noted writers, will serve to inspire and encourage those who are inclined toward pioneering work in any kind of humanitarian service.—S. A. F.

Factors in the Sex Life of Seven Hundred Psychopathic Women. By Frances M. Strakosch. State Hospital press, Utica, New York, 1934. 102 pp., tables. Price, $1.

This is a statistical study of the incidence of sex experiences and sex practices in the mentally ill. Comparison is made with similar studies among nonpsychotics. This study shows that sex practices are as extensively indulged in by the nonpsychotic as by the psychotic group.—C. P. P.

Food, Health, Vitamins. By R. H. A. Plimmer and Violet G. Plimmer. Longmans, Green and Co., London and New York, 7th edition, 1935. 178 pp., tables, figs. Price, 3s.6d.

The present edition of this book follows the same line of presentation as the earlier editions, although many changes have been made. This book is a comprehensive survey of the whole problem of nutrition, special emphasis being given to the

importance for health of an adequate supply of the several vitamins. The rôle of mineral salts has not been given proper emphasis in the discussion of this problem. The book is written concisely and in plain language to be within the reach of every housekeeper. It is essentially a practical book and can be recommended not only to the busy housewife but also to medical men planning diets for their patients.—I. C.

Handbook of Chemistry and Physics; a Ready Reference Book of Chemical and Physical Data. By Charles D. Hodgman. Chemical rubber publishing co., Cleveland, Ohio, 20th edition, 1935. 1951 pp., tables. Price, $6.

The 20th edition of this handbook is an authentic guide and reference in the sciences of chemistry and physics. It consists of 1951 pages of up-to-date data. The handbook is divided into five sections, approximately equal in size. These sections are indicated by inserts of stiff colored paper on which is printed a summary of the contents of each section. The five sections are: (1) Mathematical tables, (2) Properties and physical constants, (3) General Chemical tables, (4) Heat, Hygrometry, Sound, Electricity, and Light; (5) Quantities and Units—Miscellaneous Tables.—F. D. R.

Heart Disease in the Tropics. By H. O. Gunewardene. Butterworth & Co., Ltd., Calcutta, Madras, 1935. 101 pp., plates. Price, 5 Rs.

Books on tropical diseases are always welcomed by physicians in this part of the world. It is a common experience for students and new physicians, and also for the more experienced practitioners in the Tropics, to be misled by descriptions and symptomatology found in standard text books written for colder countries, descriptions and symptomatology which do not conform to the manifestations of the disease as found in the Tropics. While this is true to a lesser extent of heart diseases, there still exist a few important clinical differences, which, as Gunewardene points out, are enough to modify considerably the clinical picture and the prognosis. If for no other reason than to find out what a man of considerable medical experience in a tropical country (Ceylon) has to say on the peculiarities of heart disease in warm countries, this book should be read by physicians working both in the Tropics and in temperate regions.

The object of the author in writing the ninety pages which constitute the book is, in his own words, "to indicate features in cardio-vascular diseases induced by tropical conditions and

by diseases peculiar to the tropics." Some of the author's findings and observations are quite interesting. The emphasis he puts on ankylostoma infestation as a cause of cardiac disability is intriguing. According to the author this causative factor is so prominent in Ceylon that this form of cardiac disease is known there as "poor man's heart disease." In the chapter exclusively dedicated to this topic he gives several interesting data which certainly make a more careful study of ankylostomiasis in the Philippines and other tropical countries imperative. The author calls attention to a presystolic murmur frequently found in these cases; a murmur which is not so definite as that found in mitral stenosis and is not accompanied by a thrill. It is more like the Austin Flint murmur of the so-called "functional mitral stenosis" accompanying aortic regurgitation. The types of cardiac involvement in these cases of ankylostomiasis, according to the author, vary from simple breathlessness accompanied by systolic murmurs at the base or apex, to serious impairment, with a clinical picture of cardiac failure or of subacute bacterial endocarditis. In some cases sudden death is the termination. This would mean either a toxic effect from poisons excreted by the ankylostoma or an effect of direct invasion which would be demonstrated. This view is interesting in the light of recent studies made by Africa, de Leon, and Garcia on fatal cases diagnosed as adult beriberi and acute cardiac failure, where the usual definite specific pathology could not be found. In these cases, heterophyid eggs were found in the heart producing specific tissue changes. The adults are found in the intestines. Although ankylostomiasis is common in the Philippines, it is not usual to observe cases of such severity as Gunewardene describes, and which he mentions to be very common in Ceylon. This at once suggests geographical variation in the manifestation of disease even under similar climatic conditions.

The author's observations on rheumatic disease and high blood pressure practically coincide with our experience in the Philippines; only we seldom find the nonprogressive valvular disease he describes, probably because the cases do not come to the attention of the physician until the disease is advanced enough to produce alarming symptoms.

The little book is as a whole a good example of sound clinical description and observation, and distinctly belongs to the British School.

It should be read by those interested in tropical medical practice.—A. L.

Mechanical Tests for Engineering Materials. By A. M. Roberts. The Draughtsman publishing co., London, 1935–36. 89 pp., illus. tables, diagrs. Price, 4s.

The Association of Engineering and Shipbuilding Draughtsmen has issued this compact manual for testing materials. Particularly interesting is the testing machine used in the measurement of "Creep" of metals subjected to high temperatures. The book is profusely illustrated and should prove of interest to Engineers.—F. D. R.

The Practice of Veterinary Medicine. By D. H. Udall. Norton Printing Company, Ithaca, New York, 2d ed., 1936. 273 pp., illus., tables. Price, $5.

The book is a concise, thorough, to the point, and up-to-date text on veterinary practice. It certainly fills the need of the student, the teacher of ambulatory clinics and medicine, and the practitioner, as it embodies the most recent work, not only on constitutional disorders of herbivorous animals but also on their infections and parasitic diseases and on poisoning. While it is concise, it contains as much detail as one ordinarily cares to know, and, besides, discusses important subjects that have been worked out thoroughly during the last few years.

The author arranged the text into ten main groups: (1) diseases of the respiratory system, (2) diseases of the digestive system, (3) diseases of the kidneys, (4) diseases of the heart, (5) diseases of the blood-forming organs, (6) diseases of the nervous system, (7) diseases of the spine, (8) disorders of metabolism, (9) infectious diseases, and (10) poisoning.

The book is profusely illustrated. The original references appended to the discussion of each disease are of great value to the reader who desires to have more information.

As a whole, the subject matter is well presented. The work should be warmly welcomed by, and should be in the hands of, every practicing veterinarian, teacher, and student, because it is an exposition of the accurate observations on, and the up-to-date methods of handling and treatment of, the most common animal diseases, as acquired by the author and his associates in about twenty years of practice and research. Since no single man can be expected to write on all of the subjects discussed from his own personal experience alone, much of the

material contained in this book was necessarily obtained from other good sources.

Many of the diseases are discussed in a manner apparently more complete and more elucidating than in most similar text books in circulation today. Of these, traumatic gastritis in ruminants, chronic mastitis, acetonæmia, milk fever, azoturia, osteoporosis, pregnancy disease of ewes, white scours in calves, navel ill, and Bang's disease may be mentioned.

The book is 11 × 8½ inches, which is an unhandy size, yet the type, although small, is clear and readable, and the paper used is of excellent quality—E. C. F.

Press Photography. By James C. Kinkaid. American photographic publishing co., Boston, 1936. 281 pp., illus. Price, $3.

Press Photography by James C. Kinkaid is a very practical and modern guide to the news cameraman as well as to the amateur and professional. It deals with all the general principles of photographic art, especially for modern newspaper work. The author explains detail by detail all the necessary knowledge to become successful in the line, and also emphasizes the right kind of camera, its make-up, the construction of a darkroom, chemicals for development and fixing, rapid and high speed processing, and many other pertinent topics.

Modern publishers call for more and better illustrations, like photographs, in order to give the reading public graphic news of the day. Action pictures of important events are always seen in newspapers and magazines. Panoramic and other views are also published, which of course are of great importance to historians and scientific men.

This book will greatly aid our news photographers as well as those engaged in photography as a profession.—C. A. S.

Prostitution; an Investigation of its Causes, Especially with regard to Hereditary Factors. By Tage Kemp. Levin & Munksgaard, Einar Munksgaard, Copenhagen; William Heinemann (Medical Books), Ltd., London, 1936. 253 pp., tables, figs. Price, 10 Kr.

Dr. Tage Kemp's book, translated from the original Danish by Miss E. M. Werner Kornerup, is the outgrowth of several years of case study and research. It is an exhaustive work, covering group and individual implications and the scientific and social phenomena forming the background of prostitution. Special attention is given to the causal significance of hereditary factors, inclusive of the psychological and physical, to which the author's investigations were particularly directed. En-

vironmental conditions in childhood and adolescence are also considered. The observations from heredity and environment show a parallel trend, the author concluding on the one hand "that the total mental personality which specially predisposes to prostitution is frequently hereditary" and finding, on the other, "that the childhood and youthful environment of the *propositae* was, on the whole, extremely bad." Doctor Kemp defines the mental characteristics of the propositæ and in a number of specific cases with full records given he analyses the different abnormalities, chiefly psychiatric, exhibited by his medicopsychiatric examination of five hundred and thirty prostitutes. For the borderline group, the majority being maladjusted or pathological and only a small number normal, he suggests a way of treatment. In the discussion of physical diseases, the venereal naturally was emphasized. The aspect of social responsibility or the social determinants is further recognized in the various circumstances in adulthood, in addition to those in early age, which, according to the author, are direct or contributory causes of prostitution. Provisions for the punishment and readaptation of prostitutes are finally illustrated. In his recommendations, Dr. Kemp stresses the early recognition and corresponding care of psychic abnormalities which at present are considered too late, when they have already led persons to ruin; a change in the rules and methods of the police and public welfare authorities, which now are altogether unsuited to the purpose; and "a general reduction of social inequality and in particular improvement of working conditions for female hands."—S. A.

Remington's Practice of Pharmacy. By E. Fullerton Cook and Charles H. LaWall, with the collaboration of Ivor Griffith, Adley B. Nichols, and Arthur Osol, and thirty-two other contributors. J. B. Lippincott company, Philadelphia, 8th ed., 1936. 2162 pp., illus. Price, buckram, $10.

With the first edition of this treatise, published in October, 1885, by the original author, Joseph P. Remington, who was well known as one of the eminent American pharmaceutical educators, and the eighth edition in August, 1936, this standard reference in pharmacy is now beginning its fifty-first year of useful service to science. The different editions of this handbook reflect in many ways the continuous progress that the different branches of the science of pharmacy have attained during the last half of a century. The commendable efforts that Professors Cook and LaWall have exerted in securing the

collaboration of their associate editors who are specialists in their lines, both as teachers and workers, have enhanced the value of the revised as well as the new chapters added in the eighth edition. There are many features of the text book that reveal the opportunities afforded to pharmacists in the pursuit of the varied branches of their profession. The volume is full of up-to-date information needed by the pharmacists engaged as chemists, analysts, and manufacturing and dispensing pharmacists. The inclusion in this edition of discussions on subjects concerning the application in pharmacy of physical chemistry, such as colloid chemistry, hydrogen-ion concentration and pH, osmotic pressure, and related properties of solutions, the preparation of isotonic solutions, the thermodynamic considerations of heat, and the measurement of physical constants, has increased to a great extent the scientific value of the chapters of the book dealing with those subjects. There are many changes in the present edition that have not only placed the text in conformity with the changes introduced in the United States Pharmacopœia, Eleventh Revision (U. S. P. XI), and the National Formulary, Sixth Edition (N. F. VI), but has made "Remington's Practice of Pharmacy" more useful as a handbook, both for study and for reference.

As the authors have stated in their preface to the edition under review, the purpose of the original author, the late Professor Joseph P. Remington, of making his "Practice of Pharmacy" a guide and inspiration to the professional pharmacists of America, has dominated every feature of this edition. It may be added that Remington's eighth edition would serve as a guide and inspiration not only to American pharmacists but to all pharmacists the world over.—P. V.

Sugar Factories and Sugar Machinery. By William Kilpatrick. Institution of Mechanical Engineers, London, 1933. 69 pp., illus., tables.

This book is published by the Institute of Mechanical Engineers of Great Britain, being a reprint of the paper read before the Glasgow and West of Scotland Branch in Glasgow, October 5, 1933. The book reviews the various methods of sugar manufacture in use at present in centrifugal sugar factories, and then proceeds with a detailed description of the machinery used in the production of sugar. The tests of electrically driven centrifugals should be of special interest to designers.—F. D. R.

Therapeutique Medicale. IX. Maladies Infectieuses et parasitaires. By M. Loeper. Masson et Cie., 1935. 414 pp. Price, 50 Fr.

This book will prove of great help to all studious practitioners and internists who are anxious to adopt the best in therapeutics. In the first part it treats thoroughly of, and gives minute instructions on, vaccination, serum therapy, bacteriotherapy, chemotherapy, proteinotherapy and hæmotherapy in connection with infectious diseases. In the second part it takes up disinfection, the treatment of the dysenteries, the curative and preventive treatment of tetanus, the treatment and prophylaxis of influenza, the bismuth therapy and bismuth prevention of syphilis, the general principles regarding the treatment of malaria, antityphoid vaccination, vaccination against diphtheria with Ramon's anatoxin, the vaccine and serum therapy of filterable virus diseases, and the therapeutics of vitamins and convalescent serums.

The exposition and discussion of the different subjects are remarkable for their clarity and precision. Throughout the text one recognizes a master who is discussing the subject or giving instructions, thus making the perusal of the book not only highly enlightening but also delightful to read.—A. V. C.

Traite D'Helminthologie Medicale et Veterinaire. By M. Neveu-Lemaire. Vigot Freres, Editeurs, Paris, 1936. 1514 pp., illus. Price, 175 Fr.

In this admirable treatise Professor Neveu-Lemaire discusses in an exhaustive manner the parasitic worms of medical and veterinary interest. The book appears oversized, due to the vast amount of knowledge which has been rapidly accumulating as a result of the active interest sustained by the numerous workers in parasitology. It is divided into four parts, of which part I, which is subtitled General Helminthology, deals with such subjects as the evolution of helminths, their habitat and localization, modes of reproduction, geographical distribution, effects on the hosts, and other general aspects of the subject. Part II, Special Helminthology, takes up the classification and description of the various parasites, their biology, pathology, diagnosis, prognosis, treatment, and prophylaxis. In parts III and IV are appended, respectively, classified lists of the definitive and intermediate hosts of the worms.

In view of the large amount of information contained in the book, it should be welcomed not only by parasitologists and

clinicians, but also by general zoölogists and sanitarians. As a volume of reference, its value is somewhat impaired by the lack of a more complete bibliography, for the benefit of those with inadequate cataloguing facilities.—M. T.

Wheat Germ Oil (Vitamin E). By August J. Pacini. The American Physician Inc., New York, 1935. 96 pp. Price, $1.

This little book gives a very good discussion of vitamin E and the wheat-germ oil from which it may be obtained.

Vitamin E is the reproduction (antisterility) vitamin. The importance of this vitamin for vigor and reproduction and the serious effects of its deficiency are presented in a popular review. As the author states, "Surely, if wheat is the staff of life, then the oil from its germ must be the elixir of life."

The book contains important abstracts, and numerous bibliographical references concerning vitamin E.—A. J. H.